THE WEATHER AND CIRCULATION OF JANUARY 1955[1]

A Month with a Mean Wave of Record Length

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1. MEAN CIRCULATION

The mean circulation at the 700-mb. level during January 1955 was characterized by extremely long wavelengths at middle latitudes of the Northern Hemisphere. Figure 1 shows a hemispheric wave number of only three around 40°–45° N., with principal troughs located in Europe, Japan, and the western Atlantic, and ridges in the eastern Atlantic, eastern Pacific, and central Asia.[2] This long wavelength was sustained by a strong zonal current, in agreement with Rossby's classical wave formula [1]. Figure 2A shows the presence of a well developed mean 700-mb. jet stream in most of the hemisphere at middle latitudes, while figure 2B indicates that mean wind speeds were greater than normal in most of this area. Wind speeds decreased sharply, however, in regions of strong horizontal wind shear both north and south of the principal jet axis. Partly as a result, wavelengths were considerably shorter at both high and low latitudes than they were at middle latitudes. At higher latitudes, for example, there are 4 troughs in figure 1, with several additional troughs at low latitudes, over lower California, Iran, India, and the central Pacific.

Of particular interest is the long half wavelength which existed in the northern United States on the monthly mean chart between the ridge off the west coast and the trough off the east coast.[2] Measured at the 40° latitude circle, the distance between this ridge and trough in figure 1 is 81° longitude, the longest half wavelength ever observed on a 700-mb. monthly mean chart in this area at 40° N. In a previous paper [2] the author has demonstrated that systems with long half wavelengths on monthly mean charts in North America during winter are usually characterized by the following additional properties: Large amplitude in both North America and the Pacific, large difference in speed between strong winds at the trough and weak winds at the ridge, trough deeper and farther east than normal, ridge stronger and farther west than normal, trough with less northeast-southwest tilt than usual, and low value of the hemispheric zonal index.

TABLE 1.—*Comparison between mean winter values of various wave properties on monthly mean 700-mb. charts and January 1955 values (from fig. 1)*

Property	Winter mean	January 1955
Trough location at 40° N.	77° W.	56° W.
Ridge location at 40° N.	123° W.	137° W.
Ridge location along contour (upstream from trough at 40° N.)	124° W.	130° W.
Half wavelength at 40° N.	46° of long.	81° of long.
Contour half wavelength (upstream from trough at 40° N.).	47° of long.	74° of long.
Amplitude (upstream along contour from trough at 40° N.).	12° of lat.	23° of lat.
Geostrophic wind speed at trough at 40° N.	16 m. p. s.	16 m. p. s.
Geostrophic wind speed at ridge (upstream along contour).	10 m. p. s.	6 m. p. s.
Wind speed difference (trough minus ridge)	6 m. p. s.	10 m. p. s.
Height at trough at 40° N.	9, 650 ft.	9, 320 ft.
Height anomaly at trough at 40° N.	−113 ft.	−500 ft.
Height anomaly at ridge (upstream along contour)	+81 ft.	+120 ft.
Horizontal trough tilt (30° N. location–50° N. location)	14° of long.	8° of long.
Amplitude from ridge upstream to Pacific trough	15° of lat.	21° of lat.
Zonal index in Western Hemisphere	11.8 m. p. s.	10.6 m. p. s.

Every one of these typical concomitants of long wavelength was present this month, as indicated in table 1 which compares the mean values of these characteristics during all winter months from December 1932 to March 1951 (col. 2), with their values in January 1955 obtained from figure 1 (col. 3). To further illustrate the fact that this month's wave pattern, despite its extreme nature, generally satisfied the interrelationships previously established for monthly mean waves, table 2 was prepared. This table lists six values of wave amplitude for January 1955, estimated from simultaneous values of other wave

TABLE 2.—*Values of double amplitude (in ° lat. measured from trough at 40° N. upstream along contour to ridge in western Canada) obtained by entering graphs of [2] with January 1955 values of various wave properties (measured from fig. 1 and listed in table 1)*

Figure no. in ref. [2]	Dependent variables	Estimated amplitude January 1955
4	Contour half wavelength	26
5	Contour half wavelength and windspeed difference (trough minus ridge).	20
6	Height at trough and Pacific amplitude	20
14	Contour half wavelength and height at trough	26
15	Contour half wavelength and Pacific amplitude	19
16	Height anomalies at trough and ridge (upstream along contour).	22
Mean estimate		22
Actual value		23

[1] See Charts I–XV following p. 31 for analyzed climatological data for the month.

[2] Trough and ridge are defined as points of lowest and highest latitude reached by the contours.

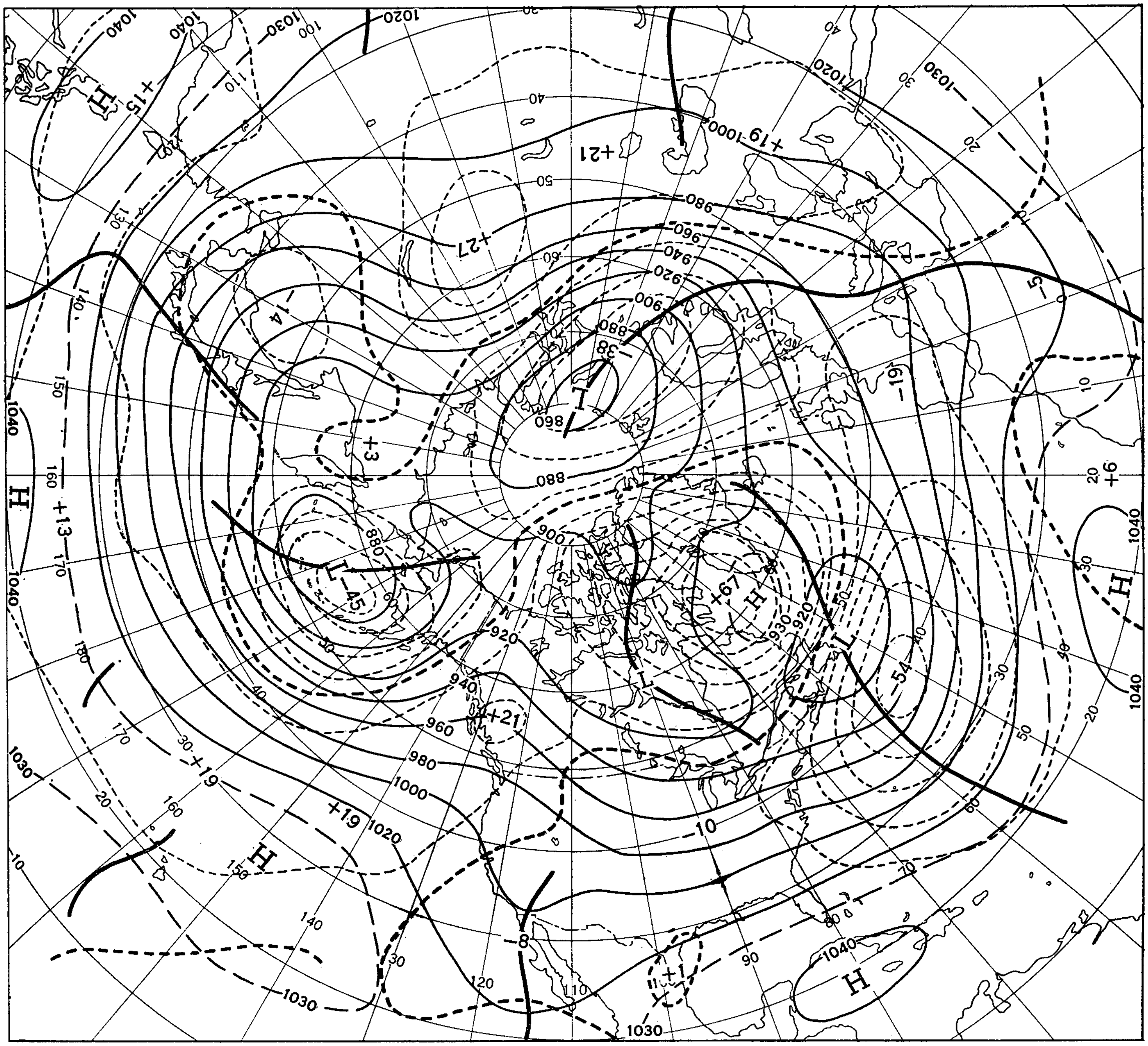

FIGURE 1.—Mean 700-mb. contours and height departure from normal (both in tens of feet) for January 1–30, 1955. Note long half wavelength at 40° N. between stronger than normal ridge in eastern Pacific and deepest mean trough on record in western Atlantic. Other significant features are strong blocking High over Davis Strait and deep Aleutian Low.

characteristics in figure 1 on the basis of graphs presented in 1952 [2]. All of the estimated amplitudes are in good agreement with the value of 23° of latitude actually observed, and the mean estimate differs from the actual by only 1°.

This month's extremely long wavelength in the northern United States can be rationalized in another way. After all, the system of locating a trough at the lowest latitude reached by the contour is an arbitrary one. If, instead, we define a trough as a region of maximum contour curvature, then there is a trough through the Mississippi Valley in figure 1, where a separate center of negative height anomaly also appears. In fact, a minimum-latitude trough was actually present in this area during the second half of the month, as illustrated by the 15-day mean map in figure 3B. During the first half of the month the wavelength slack was taken up by the trough in the southwest United States, which extended to latitude 43° N. on the 15-day mean map in figure 3A, but to only 37° N. on the monthly mean chart (fig. 1). The monthly mean, with its long wavelength, was therefore the average of two different half-month circulations, each with a normal wavelength.

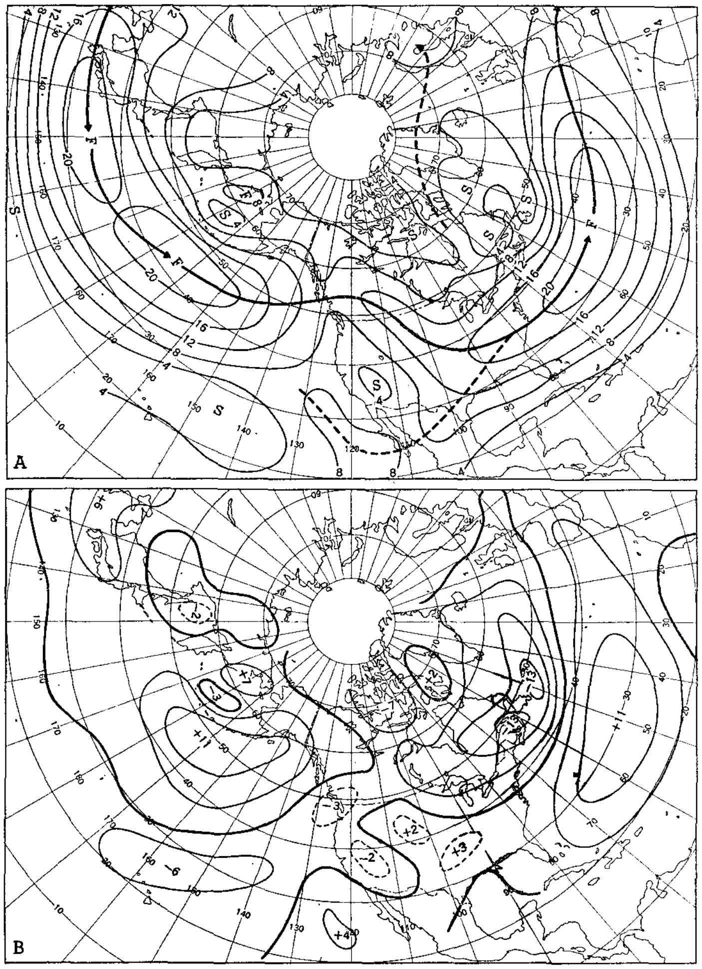

FIGURE 2.—(A) Mean 700-mb. isotachs and (B) departure from normal wind speed (both in meters per second) for January 1–30, 1955. Solid arrows indicate position of the mean 700-mb. jet stream, which was north of its normal location in the Pacific, displaced south of normal by blocking in the Atlantic, and stronger than normal nearly everywhere. Dashed lines delineate secondary axes of maximum wind speed.

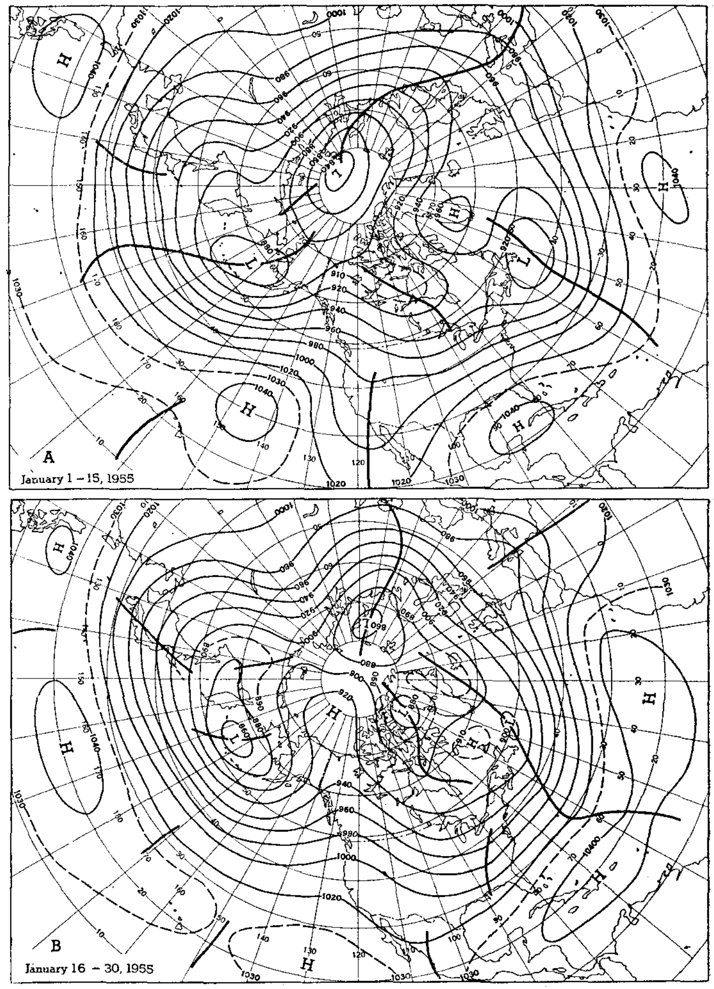

FIGURE 3.—Mean 700-mb. contours for (A) January 1–15 and (B) January 16–30, 1955. First half of month was characterized by strong blocking High over Greenland, strong subtropical High in Gulf of Mexico, and deep trough in western United States. During the second half of the month blocking relaxed in the Atlantic, the ridge intensified in western North America, and a deep trough developed in the eastern United States.

The most anomalous features of this month's hemispheric circulation were found in the Atlantic (fig. 1). Mean 700-mb. heights in the trough south of Newfoundland were the lowest observed during any month on record, beginning October 1932. The extreme negative height anomaly of −540 ft. represented a departure of more than 3 standard deviation units—a rare event. At sea level (Chart XI) pressures in a 992-mb. mean Low southeast of Newfoundland averaged 23 mb. below normal, the largest anomaly in any part of the Atlantic during any January in the 56 years of record dating back to 1899.

The abnormal displacement of the Icelandic Low to Newfoundland was intimately related to the presence of a strong blocking High over the Davis Strait where extreme positive departures were 670 ft. at 700 mb. and 21 mb. at sea level. This block was accompanied in typical fashion by a split jet stream with the principal current passing south of the block and a weak secondary branch diverted around its northern periphery (fig. 2A). Positive height anomalies extended westward at high latitudes in a broad band from Iceland to Alaska, with an unbroken belt of negative anomalies to the south extending from California to the Mediterranean Sea. Development of this block was responsible for displacing the deep polar vortex, which had played a prominent role in the weather and circulation of the previous two months [3, 4], from the Canadian Arctic into Novaya Zemlya. This change came about mainly during the second half of the month, when a closed High developed in the Arctic north of Alaska at the same time that the original block over Greenland and eastern Canada became much weaker (compare figs. 3A and B).

In order to facilitate comparison between this month's circulation pattern and the typical January condition, figure 4 was prepared showing the frequency of troughs and ridges within equal-area 10° boxes from 20° to 70° N. on all monthly mean 700-mb. charts for January from

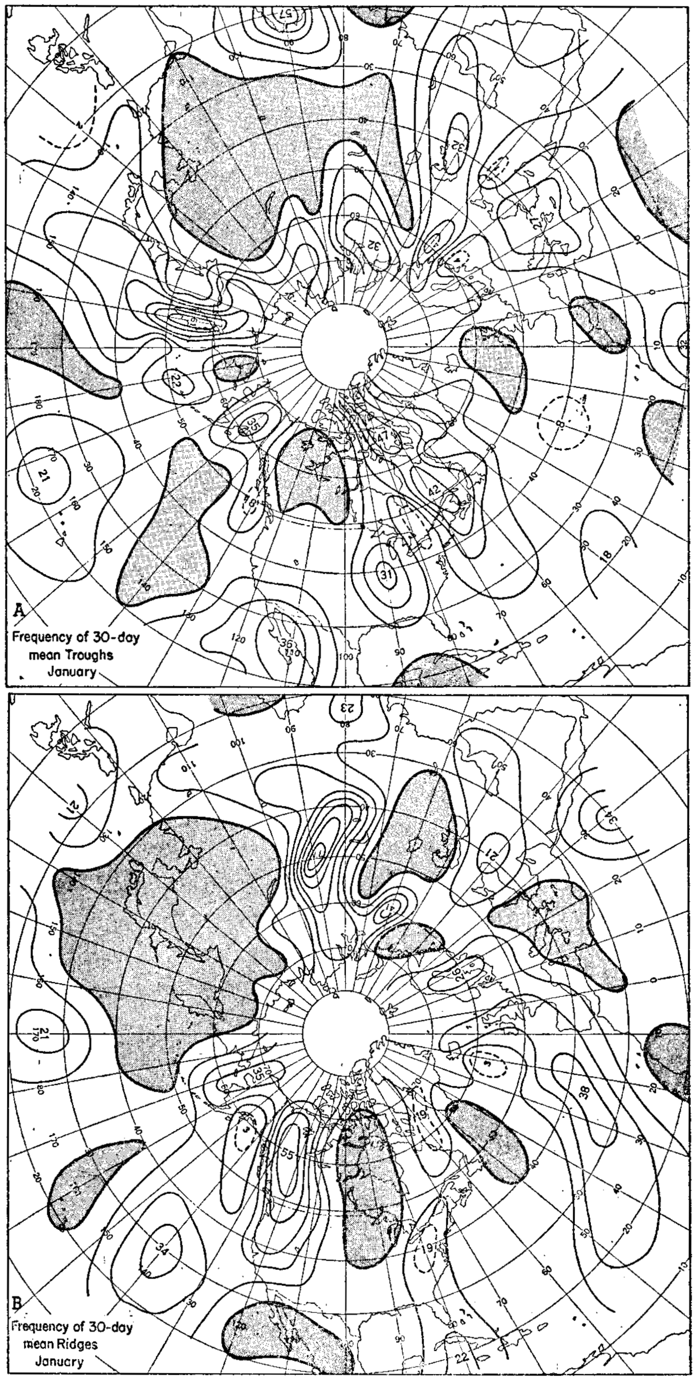

FIGURE 4.—Geographical frequency (%) of monthly mean troughs (A) and ridges (B) within equal-area 10° boxes from 20° to 70° N. on 700-mb. charts for January from 1933 to 1955. The lines of equal frequency are drawn at intervals of 10 percent except for intermediate (5%) lines which are dashed. Areas of zero frequency are stippled. Centers of maximum frequency are labeled in roman type, centers of minimum frequency in italics.

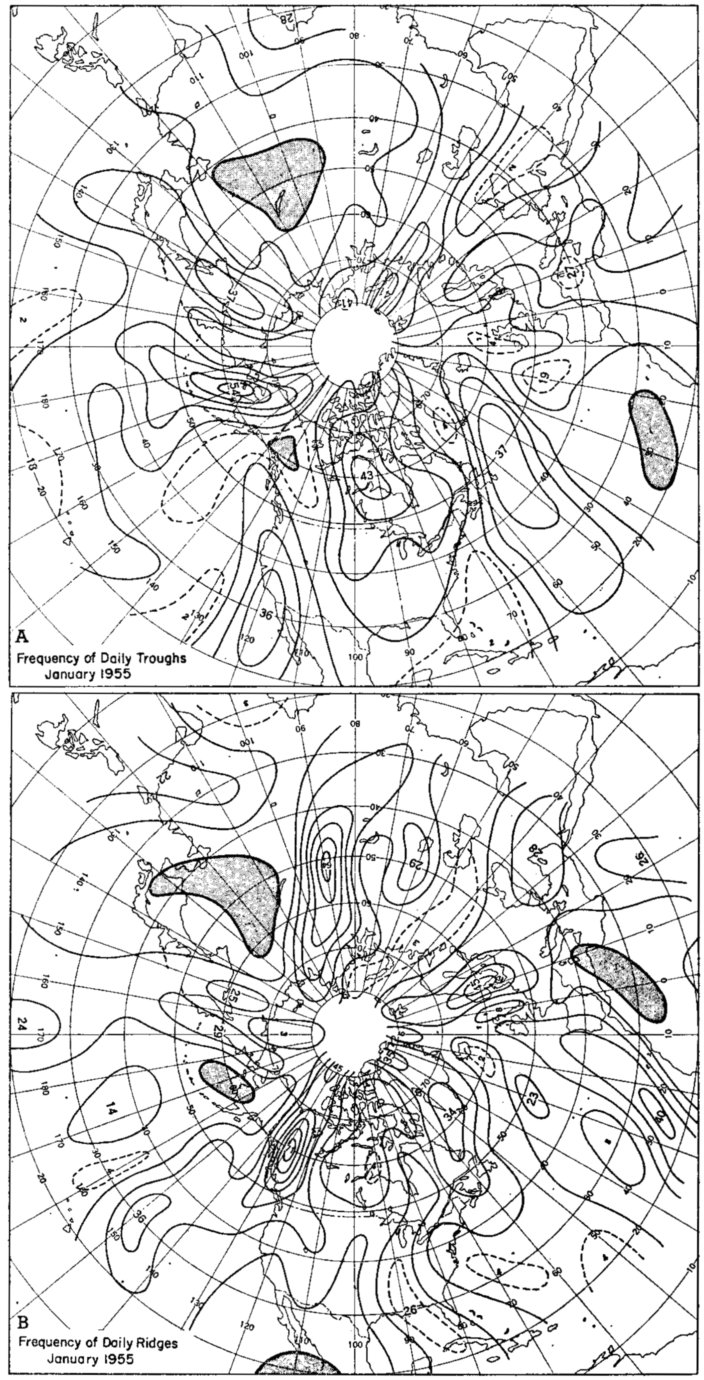

FIGURE 5.—Geographical frequency (%) of daily troughs (A) and ridges (B) from 20° to 80° N. on 1500 GMT 700-mb. charts for January 1955. Analysis is same as in figure 4.

1933 to 1955. Similar studies have been published for the winter season [2] and for daily maps [5]. Comparison with figure 1 reveals that every ridge in the Northern Hemisphere on this month's mean chart was located close to an axis of maximum frequency of ridge occurrence in figure 4B. This was especially true of the ridges in western Canada and central Siberia, both of which were situated in regions where ridges were present in more than half of the Januarys since 1933.

The troughs on this month's 700-mb. map were not located as close as were the ridges to their modal or most frequent January positions. Nevertheless, most troughs in figure 1 were situated within 10° of longitude from an axis of maximum trough frequency in figure 4A; and some, such as the troughs through Lower California, North Africa, Baffin Bay, and the Caspian Sea, were extremely close to these axes. The largest displacements from preferred position were found in the vicinity of the Atlantic block, which was accompanied by a trough through Hudson Bay some 20° west of its modal position and a trough through Iceland and Newfoundland about 20° east of the modal position.

2. DAILY COMPONENTS

In order to shed some light on the manner in which this month's mean circulation was made up, the locations of *all* minimum-latitude troughs and *maximum-latitude* ridges at 10° lat. intervals from 20° to 80° N. on the 1500 GMT 700-mb. map for each day of the month were tabulated. The total number of days with troughs or ridges within equal-area 10° boxes was then expressed as a percentage and analyzed as shown in figure 5. Thus the isopleths in figure 5 show the percent of time that troughs or ridges were present on daily maps during January 1955,[3] just as the isopleths in figure 4 show the percent of time that troughs or ridges were present on monthly mean maps during 23 previous Januarys. The two figures have many features in common. In neither is there a uniform distribution of troughs or ridges. Instead both show a high frequency of troughs in Lower California, Novaya Zemlya, the Caspian Sea, and the Hawaiian Islands, and a maximum frequency of ridges over the Canadian Rockies, southeast Pacific, eastern Atlantic, and west of Lake Baikal. Likewise both figures show a complete absence of troughs or ridges in certain areas—troughs in the Yukon, southeast Atlantic, and Lake Baikal areas, and ridges in eastern Asia, Lower California, and the Mediterranean. These similarities may indicate that some of the topographic and thermal influences responsible for the fact that troughs and ridges prefer certain areas and avoid others on monthly mean maps also operate to produce areas of preference on daily maps. The effect of these normal factors, however, is not as great on daily maps as on monthly means since areas of zero frequency are much smaller in figure 5 than in figure 4.

The difference between figures 4 and 5 can be directly related to figure 1. Wherever the monthly mean troughs or ridges of figure 1 were west of the modal positions of figure 4, the axis of maximum frequency in figure 5 was also west of the corresponding axis in figure 4, as in the case of troughs in Hudson Bay, Japan, and the Mediterranean and ridges in Kamchatka and the eastern Pacific. On the other hand, axes of maximum frequency in figure 5 were east of their counterparts in figure 4 when the monthly mean trough or ridge of figure 1 was displaced east of its modal position—most conspicuously in the case of the deep trough in the western Atlantic. At the same time, every monthly mean trough and ridge in figure 1, without exception, was located in an axis of maximum frequency of daily troughs or ridges in figure 5. In other words the distribution of daily troughs and ridges in figure 5 and the monthly mean map of figure 1 were closely interrelated, so that the mean troughs and ridges were the sites of *frequent daily activity.*

Intensity and speed of daily troughs and ridges were also important factors in determining the monthly mean flow pattern, since many axes of maximum frequency in figure 5 do not correspond to mean troughs or ridges in figure 1. For example, at 40° N., daily ridges were just as frequent in the Mississippi Valley as in the mean ridge in the eastern Pacific; while daily troughs were almost as frequent in the Great Plains as in the mean trough in the western Atlantic. Inspection of the daily 700-mb. maps reveals that at least one trough was present on all but three days of the month at 40° N. between 70° and 120° W., and the average half wavelength was about 30° long., about normal for daily maps in this area. Yet this was an area of extremely long wavelength on the monthly mean, without either trough or ridge in figure 1.

TABLE 3.—*Mean 700-mb. height of all daily troughs and ridges at 40° N. within ±5° of longitude of specified meridians during January 1955.*

Central longitude	Mean height of troughs	Mean height of ridges
° *W.*	*ft.*	*ft.*
30	9,500	9,920
40	9,670	9,830
50	8,940	9,970
60	9,080	9,730
70	9,350	9,810
80	9,460	9,880
90	9,340	9,950
100	9,660	9,950
110	9,880	9,900
120	9,710	10,270
130	9,580	10,330
140	9,780	10,290
150	9,600	10,250
Mean	9,504	10,006

In part to resolve this apparent conflict, table 3 has been prepared by recording 700-mb. heights at trough and ridge lines at 40° N. during each day of the month and then averaging by 10° longitude strips. This table shows that troughs at 40° N. were deeper at 50° W. than at any other meridian from 30° to 150° W. At this longitude, near the monthly mean trough, the average 700-mb. height of daily troughs was only 8940 ft. Conversely, ridges attained maximum intensity (mean 700-mb. height of 10,330 ft.) in the vicinity of 130° W., near the monthly mean ridge. In the United States proper, from 75° to 125° W., both troughs and ridges were of approximately average depth. Thus, although daily troughs and ridges were quite frequent in the northern United States during the month, they were not of sufficient intensity to be reflected as a trough or ridge on the monthly mean map. In the adjacent oceans, on the other hand, daily systems attained maximum intensity;

[3] Figure 5 does not indicate the number of *different* troughs or ridges that traversed each area during the month. Such a statistic is preferable in some ways to the number of days with troughs or ridges, but was not computed because it is more difficult to obtain and is given indirectly, for sea level systems in figure 6.

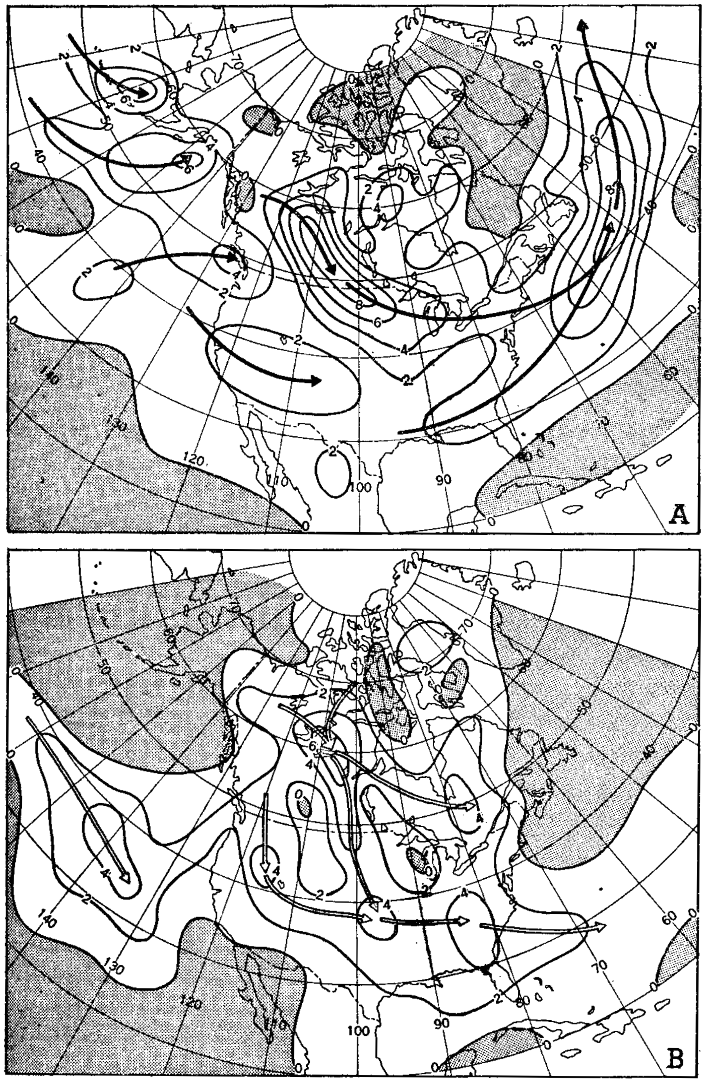

FIGURE 6.—Frequency of cyclone passages (A) and anticyclone passages (B) (within 5° squares at 45° N.) during January 1955. Note principal cyclone tracks (solid arrows) through southern and northern portions of United States, both leading to area of maximum storm frequency (8 per box) southeast of Newfoundland. Principal anticyclone tracks (open arrows) were similar to normal except for marked southward displacement in Atlantic.

and this intensification was one of the factors associated with the appearance of the monthly mean trough and ridge in these areas. This conclusion agrees with the rule used in extended forecasting practice for many years and stated by Namias [6] as "daily troughs undergo their maximum deepening when entering the area of the mean trough."

The rule cited above applies just as well to sea level cyclones as to 700-mb. troughs. This is well illustrated in Chart X by noting the progressive decrease in central pressure of low pressure systems crossing the east coast of the United States. Many of these storms deepened at an average rate of almost 1 mb. per hour as they passed over the warm waters of the Gulf Stream and entered the mean trough south of Newfoundland. Particularly noteworthy is the large number of daily storms which entered this mean trough. Figure 6A shows that as many as 8 different cyclones crossed a 5° box southeast of Newfoundland during the month. Storms approached this area along two principal tracks; one directed northeastward from the Gulf and South Atlantic States, and the other oriented southeastward from Alberta and the Upper Mississippi Valley. After leaving the center of maximum cyclone frequency off Newfoundland, nearly all storms moved in the customary direction, northeastward, across the Atlantic. However, the latitude of the Atlantic storm track was definitely south of normal because of the large blocking High in Davis Strait. This block was also responsible for a complete absence of cyclones in Davis and Denmark Straits, where they are normally more frequent than in any other part of the Northern Hemisphere in January.

Figure 6B summarizes the number of anticyclones plotted in Chart IX which crossed each 5° box during the month. It shows many features which are typical of January, including maximum frequency of anticyclones in the Great Basin, southeast Pacific, and northwest Canada, and minimum frequency in the Great Lakes, Gulf of Alaska, and north Atlantic. Also typical was the bifurcated nature of the track of polar anticyclones from Canada, with one branch curving north of the Great Lakes, and the other curving cyclonically through the Northern Plains and Ohio Valley, south of the warm lake waters. This month's large-scale anomalies in the western Atlantic were reflected in a marked southward displacement of the principal anticyclone track in that area, with most of the daily Highs concentrated in the latitude belt from 20° to 30° N. and one penetrating as far south as Puerto Rico. In fact, not one High traversed the vast expanse of water between latitudes 33° and 60° N., an area which was dominated by the huge cyclonic vortex over Newfoundland.

In this section an attempt has been made to present some evidence in support of the conclusion that many aspects of the behavior of daily systems may be inferred from knowledge of the monthly mean circulation and its departure from the long-period normal. This evidence included the percent of days with troughs and ridges (fig. 5), the number of different Lows and Highs (fig. 6), the intensity of troughs and ridges (table 3), and the intensity of cyclones (Chart X). It is obviously impossible in an article of this type to examine thoroughly all aspects of this problem. This would require much additional data and careful scrutiny of many other factors such as change in speed and amplitude of the waves from day to day.

3. THE WEATHER

This month's long half wavelength in the United States on the mean chart was accompanied by prevailing northwesterly flow in most of the country at both 700 mb. (fig. 1) and sea level (Chart XI). As a result little

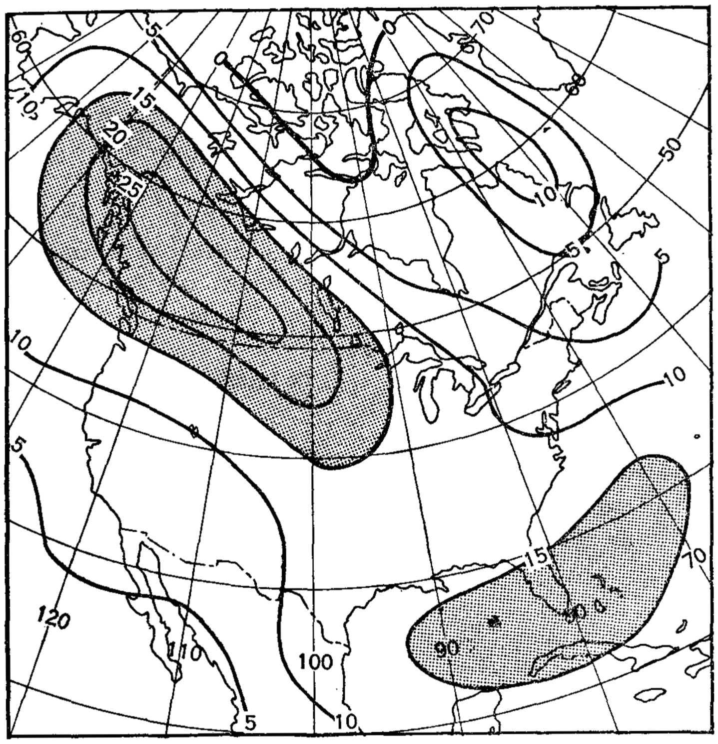

FIGURE 7.—Number of days in January 1955 with surface fronts of any type within squares with sides approximately 500 miles. Data from *Daily Weather Map* at 1:30 p. m. EST. Note maximum frequency of fronts in western Canada and the Gulf of Mexico and small frequency in the United States.

moisture was able to enter the country and generally dry weather prevailed in most sections (Chart III). Less than half the normal precipitation fell in portions of the North and Middle Atlantic States, Ohio Valley, Northern Plains, Northern Plateau, and Rocky Mountain States. Washington, D. C., reported its driest January on record with only .30 in. of precipitation all month. Statewide precipitation in adjoining Maryland and Delaware averaged only 17 percent of normal. At Blue Hill, Mass., this month was not only the driest but also the sunniest January in the 70-year history of the Observatory. In the Great Plains drought conditions were described as the worst since the days of the dust bowl in the 1930's. Statewide precipitation averaged only 35 to 38 percent of normal in Arkansas, Tennessee, Kentucky, and Virginia, but considerably greater amounts fell both north and south of this region. This area of minimum precipitation coincided with an area of minimum cyclonic frequency in figure 6A, between the two principal storm tracks through the Great Lakes and Gulf States.

The only part of the country with excess precipitation over a wide area was the Southwest, with more than twice the normal amount in most of Arizona and southern California, and above normal amounts in Nevada, Utah, and southern parts of New Mexico and Texas. This precipitation was associated with a mean 700-mb. trough through the area, a closed center of negative anomaly to the southwest, and considerable cyclonic activity at sea level (Chart X). Above normal precipitation also fell along the Gulf and South Atlantic coasts, along the principal track of sea level cyclones (fig. 6A), and north of an axis of maximum frequency of fronts (fig. 7). On the 19th one of these storms deposited up to 15 inches of snow in Virginia and 12 inches in North Carolina, but no precipitation fell in Washington, D. C., or northward. Similar situations recurred several times during the month as the southern storms were steered out to sea by the strong circulation around the quasi-stationary Newfoundland Low instead of northeastward up the Atlantic Coast in the more typical fashion.

The departure of average temperature from normal during January 1955 (Chart I-B) was negative in over half the country because mean wind components generally were northerly with respect to normal at both sea level and 700 mb. These anomalous northerly winds were strongest in the eastern and western thirds of the Nation, where the coldest weather prevailed. Extreme departures of $-8°$ F. were recorded in Nevada, where low temperatures were caused by easterly as well as by northerly flow and were intensified by radiational cooling in a well-developed Basin High at sea level.

In the central third of the Nation, on the other hand, anomalous wind components were very weak and ill defined. At sea level, in fact, weak southerly flow prevailed in a mean trough to the lee of the Rocky Mountains. As a result temperatures for the month averaged somewhat above normal in most of the Great Plains. Extreme departures ($+6°$ F.) occurred in the Northern Plains where temperatures averaged above normal during every week from the beginning of November 1954 until the second week of February 1955. The first subzero temperatures of the winter in Minneapolis, Minn., were not recorded until January 16, the latest date on record. The explanation for this extreme warmth is given best by the mean sea level map and its departure from normal (Chart XI), which had all the characteristics demonstrated by Henry [7] and Blair [8] many years ago to be concomitant with mild winters in the northern United States. The Aleutian Low was extremely well developed (16 mb. below normal) and its eastward extension produced a well defined trough in western Canada and below normal sea level pressures throughout Alaska and northwest Canada. At the same time, High pressure cells in the Great Basin and eastern Pacific were stronger than normal. As a result of this pressure distribution mild Pacific air masses dominated the Northern Plains instead of the cold Canadian air normally present. The quasi-stationary frontal zone between these two air masses was north of the United States border most of the month (fig. 7), and cyclonic activity was unusually pronounced in Alberta, Canada (fig. 6A).

Similar factors operated to produce mild Pacific air and above normal temperatures in the Pacific Northwest. Warmth in this region was also associated with above

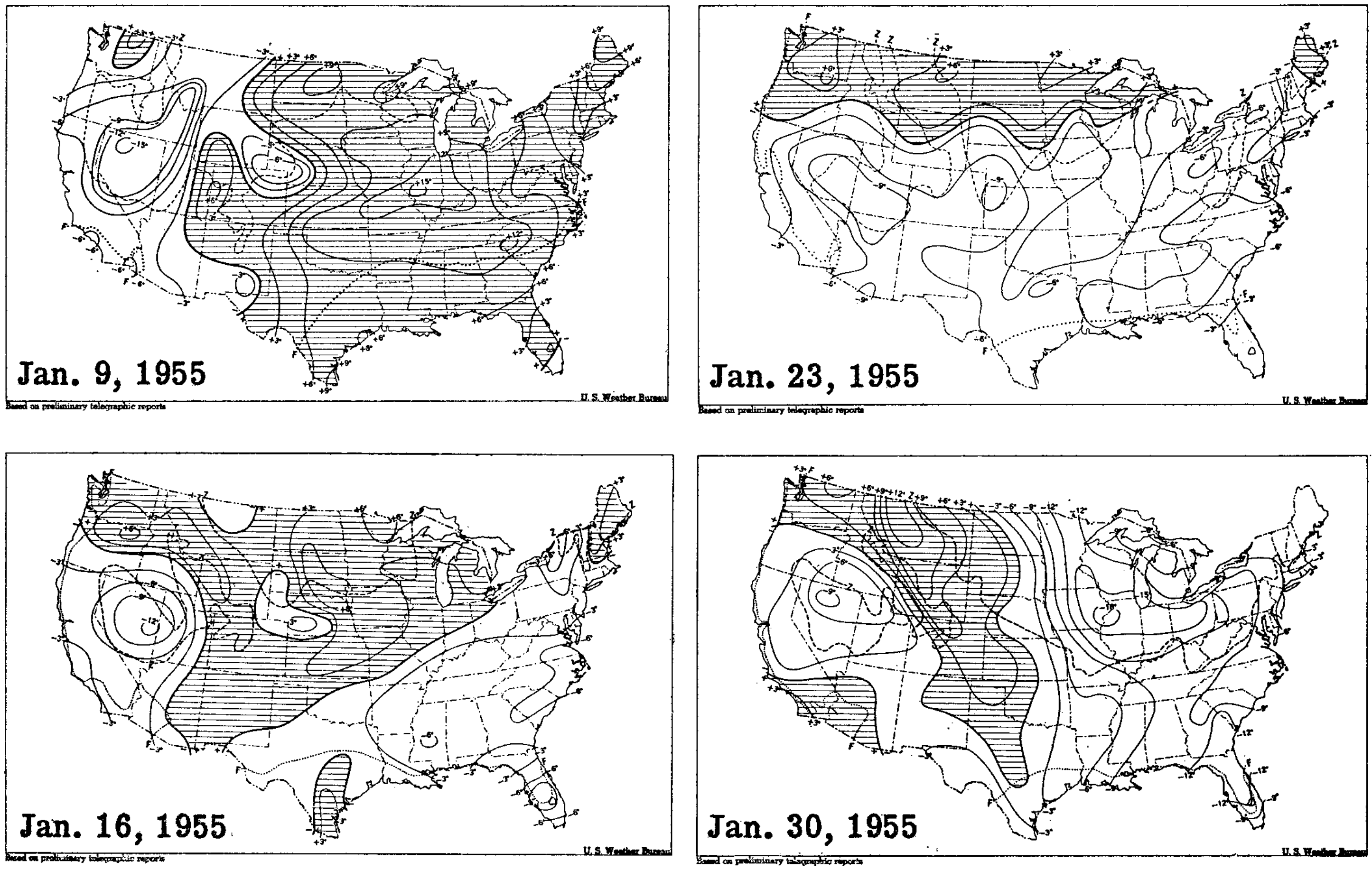

Figure 8.—Departure of average temperature from normal for the weeks ending at midnight, local time, on the dates shown. Shading indicates temperatures of normal or above; dotted line shows southern limit of freezing temperatures, dashed line southern limit of zero degrees. Note progressive cooling east of the Continental Divide. (From *Weekly Weather and Crop Bulletin, National Summary*, vol. XLII, Nos. 2, 3, 4, and 5.)

normal heights and ridge conditions at 700 mb. Mild maritime air masses were also responsible for above normal temperatures in northern New England and the Upper Lakes, where stronger than normal northeasterly winds at both sea level and 700 mb. resulted in dominance by air masses originating in the Atlantic instead of in Canada.

Figure 8 reveals an interesting temperature trend which went on during the month. During the first week of January temperatures averaged above normal in practically all parts of the country east of the Rockies—by as much as 15° F. in Illinois. Thereafter progressive cooling occurred, and a major cold wave swept the eastern half of the United States during the final week of January. The coldest weather, averaging 18° F. below normal for the week, occurred in Illinois in almost exactly the same region which had the greatest positive anomaly during the first week of January. This progressive cooling was associated with the westward spread of blocking from Greenland to Alaska during the month, as illustrated by the marked increase in amplitude of the ridge in western North America from the first to the second 15 days of the month (fig. 3).

The outstanding feature of January weather outside the United States was the effect of unusual storminess in Europe. Floods in France and Germany, blizzards in the British Isles and Scandinavia, and shipwrecks in the Mediterranean all resulted from a deeper than normal mean trough in Europe and a southward displacement of the Atlantic storm track by the block in the Greenland area. Other weather highlights included a destructive typhoon in the Philippines, the first January hurricane on record in the Atlantic, and shipwrecks in the deep trough south of Newfoundland.

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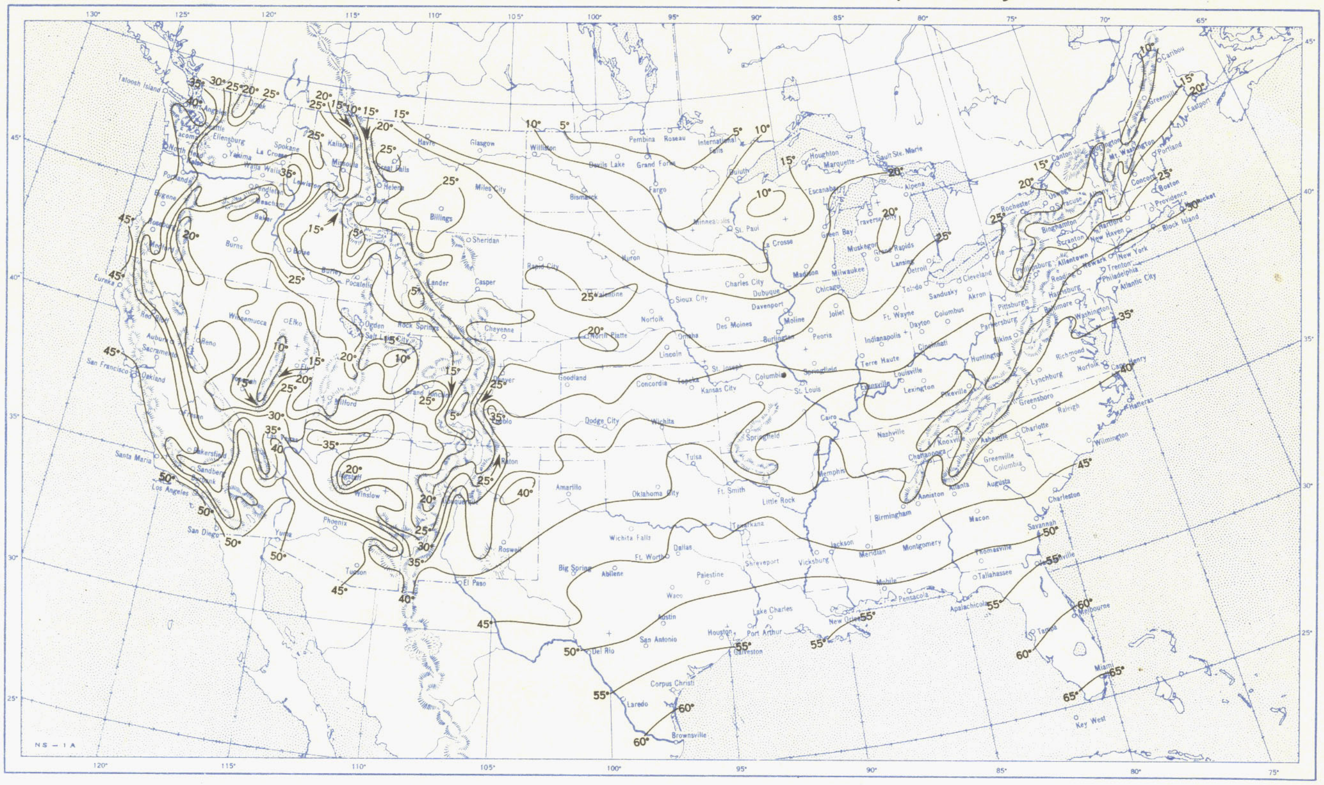
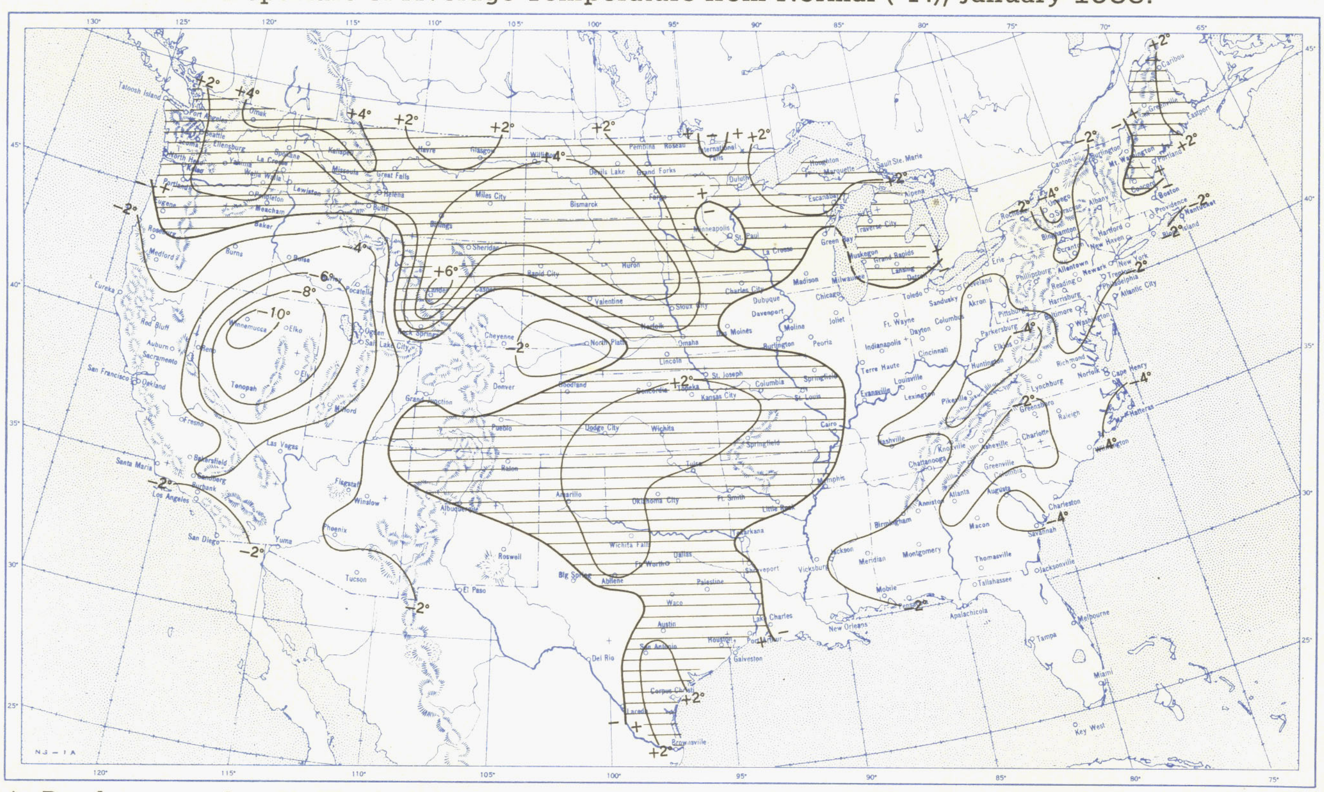
Chart I. A. Average Temperature (°F.) at Surface, January 1955.

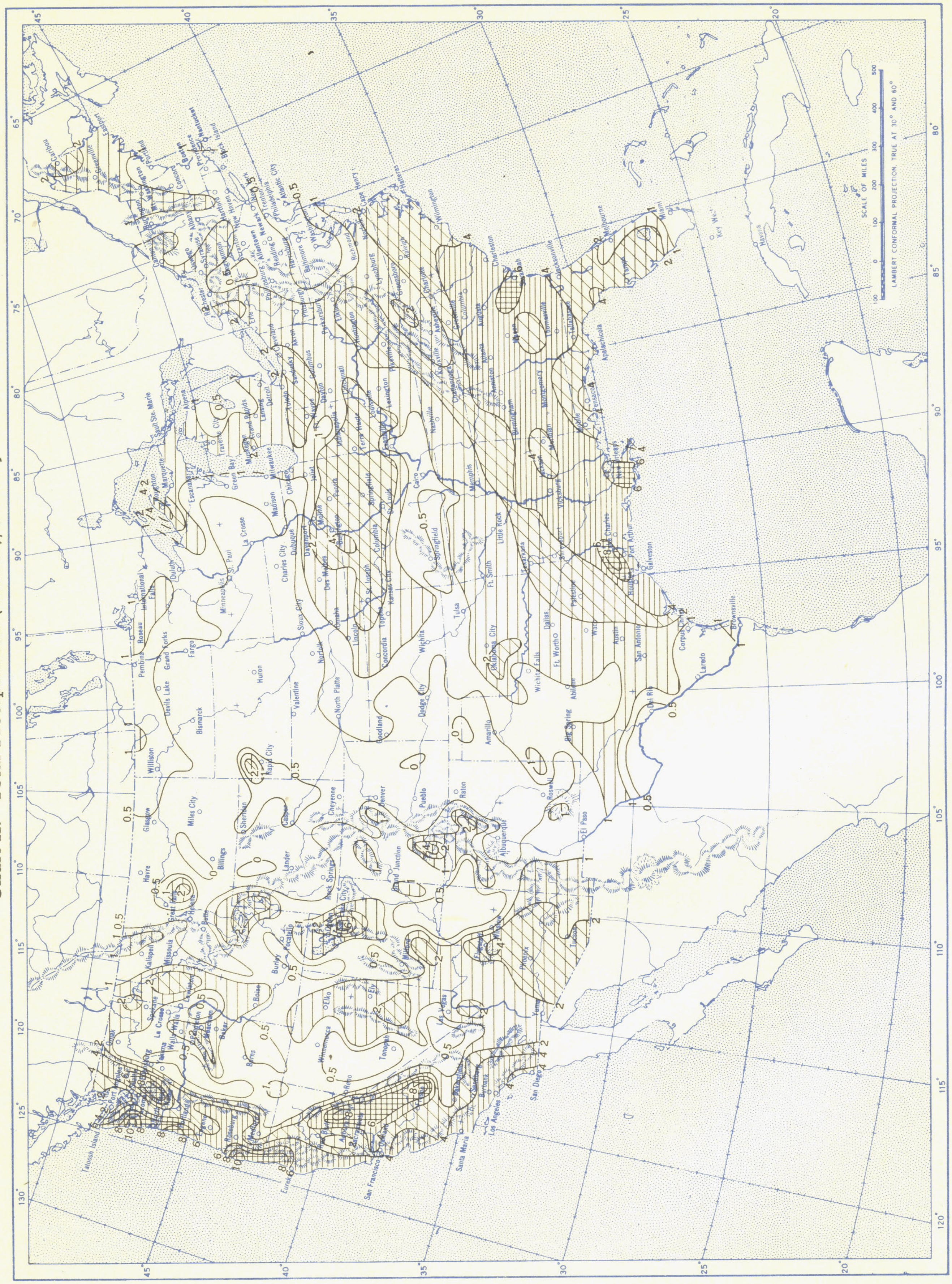


B. Departure of Average Temperature from Normal (°F.), January 1955.



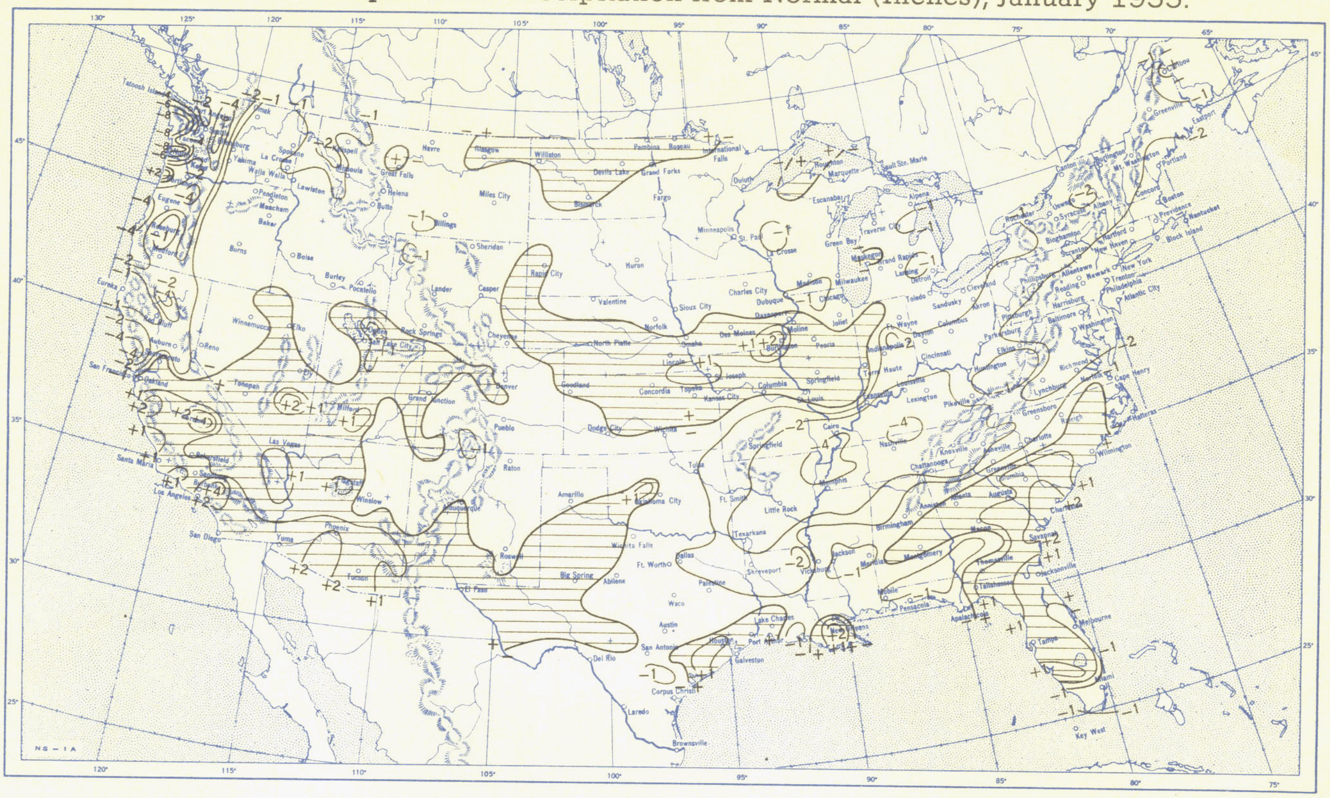
A. Based on reports from 800 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

Chart II. Total Precipitation (Inches), January 1955.

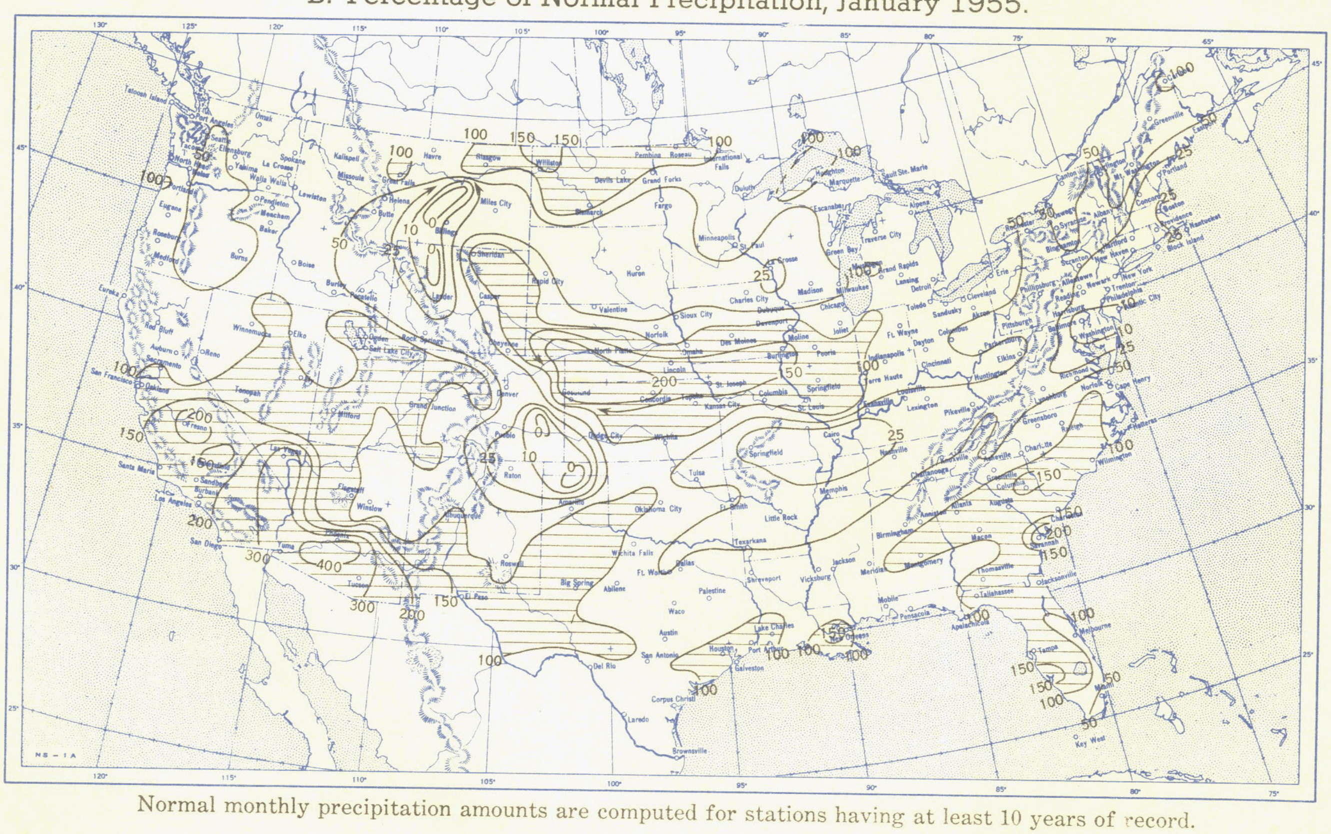


Based on daily precipitation records at 800 Weather Bureau and cooperative stations.

Chart III. A. Departure of Precipitation from Normal (Inches), January 1955.

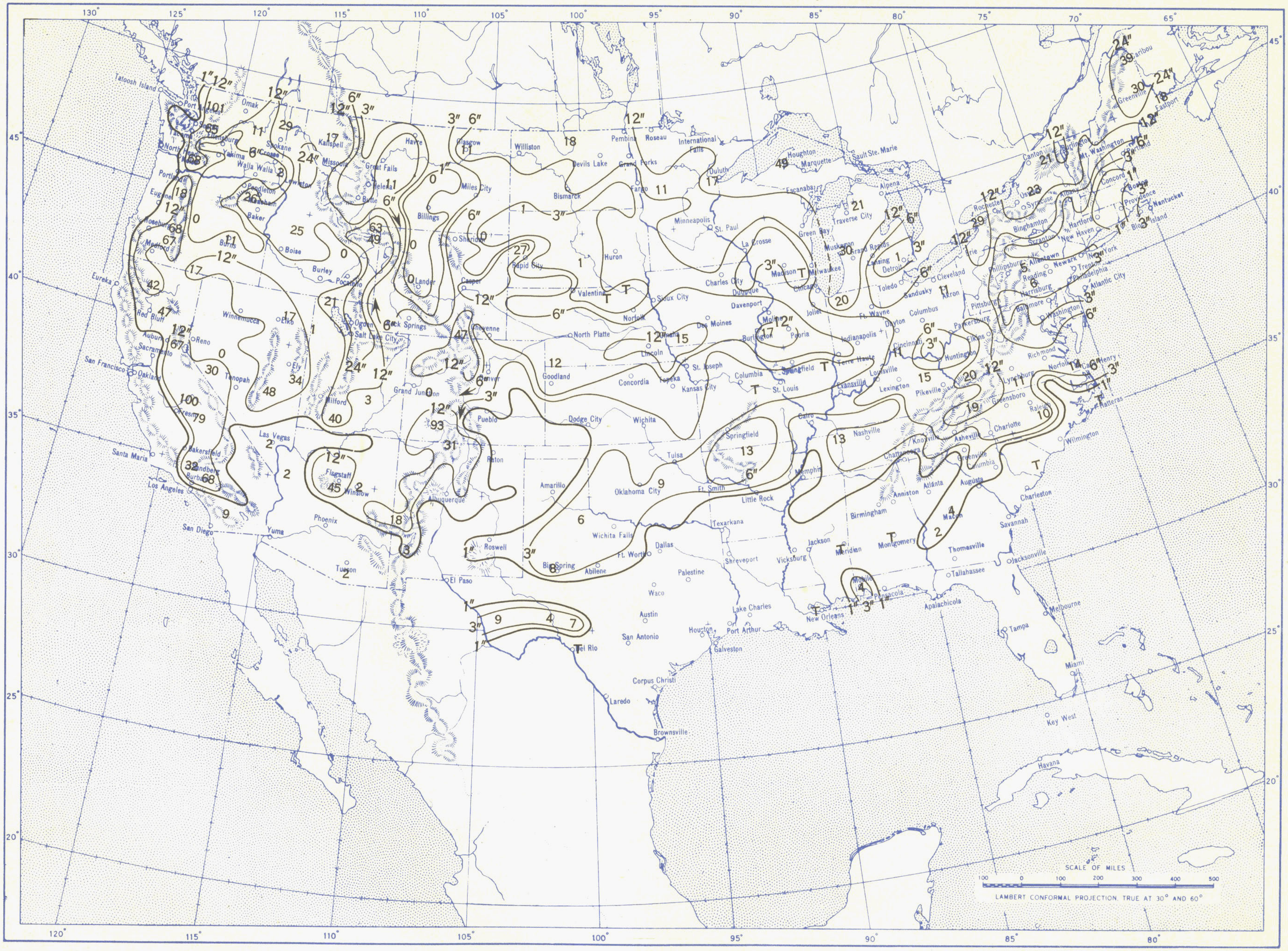


B. Percentage of Normal Precipitation, January 1955.



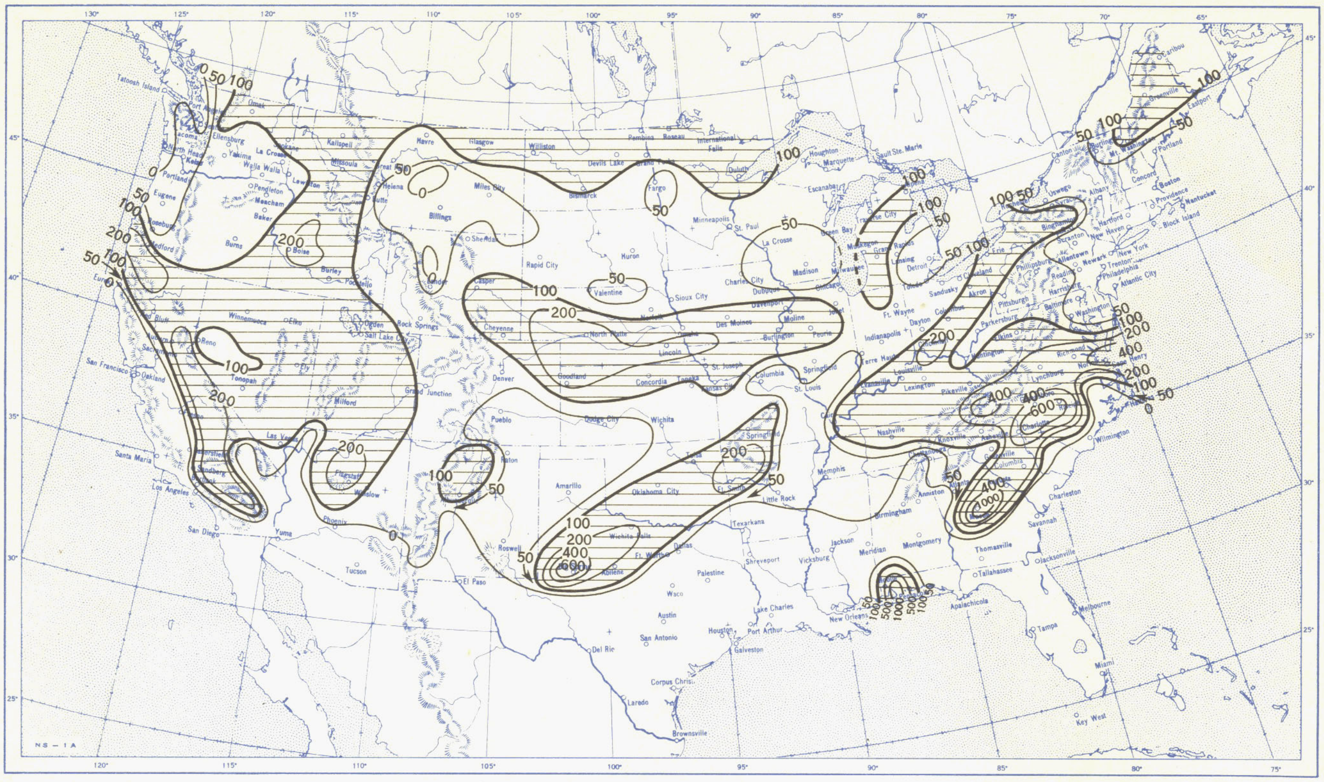
Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

Chart IV. Total Snowfall (Inches), January 1955.

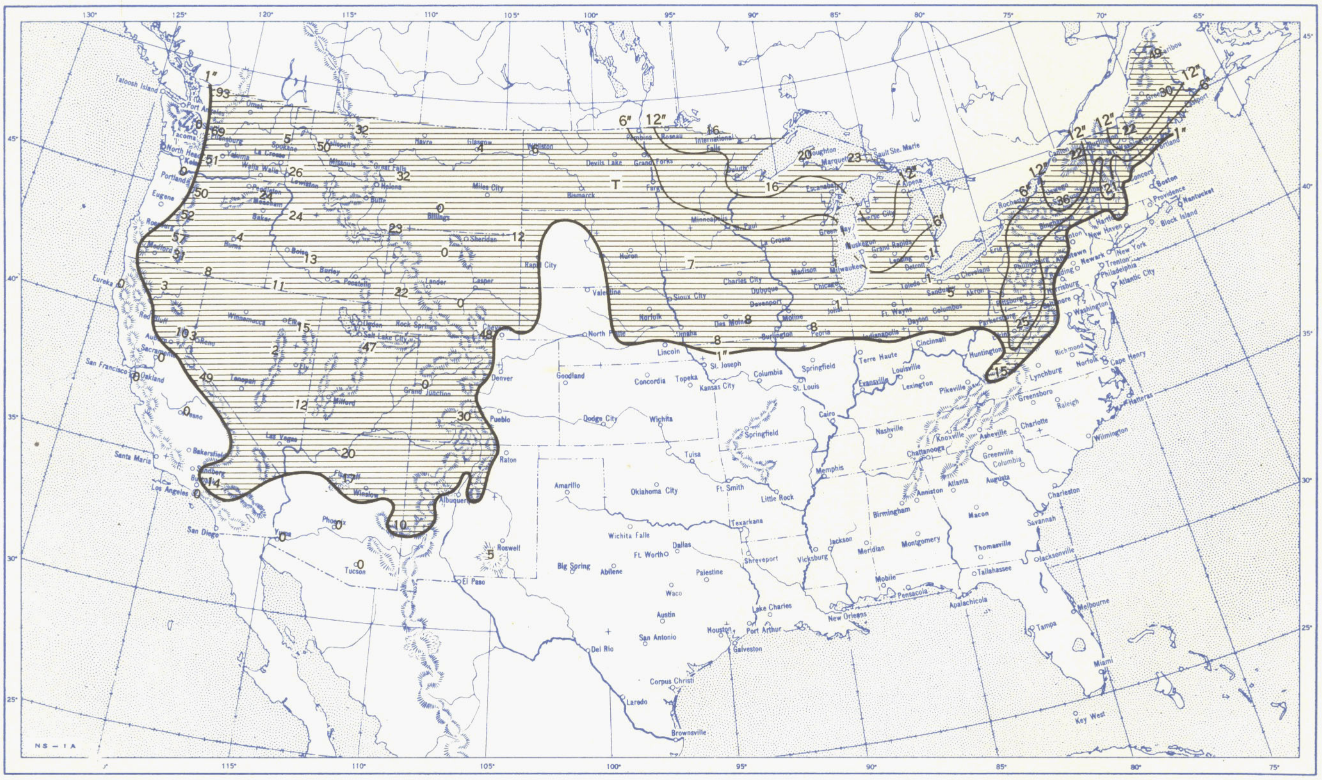


This is the total of unmelted snowfall recorded during the month at Weather Bureau and cooperative stations. This chart and Chart V are published only for the months of November through April although of course there is some snow at higher elevations, particularly in the far West, earlier and later in the year.

Chart V. A. Percentage of Normal Snowfall, January 1955.

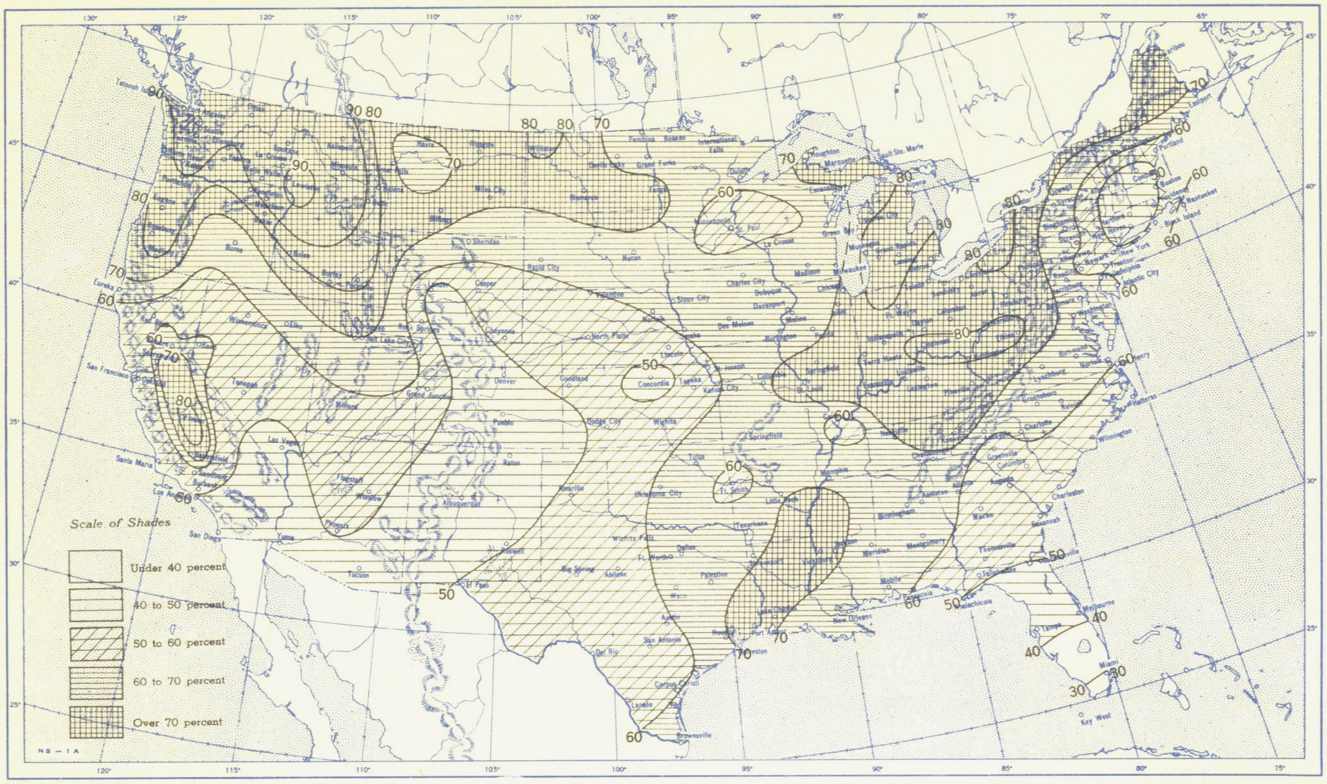


B. Depth of Snow on Ground (Inches). 7:30 a. m. E. S. T., January 31, 1955.



A. Amount of normal monthly snowfall is computed for Weather Bureau stations having at least 10 years of record.
B. Shows depth currently on ground at 7:30 a. m. E. S. T., of the Tuesday nearest the end of the month. It is based on reports from Weather Bureau and cooperative stations. Dashed line shows greatest southern extent of snowcover during month.

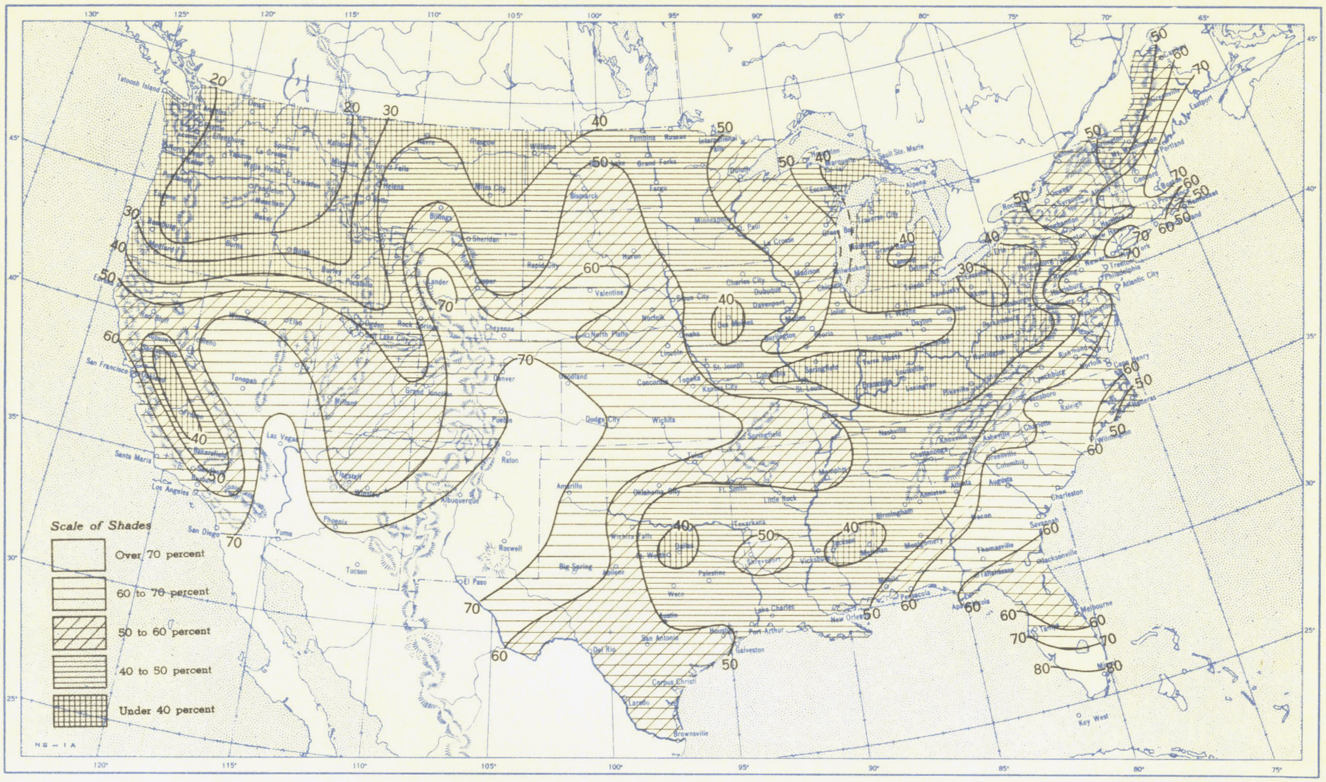
Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, January 1955.



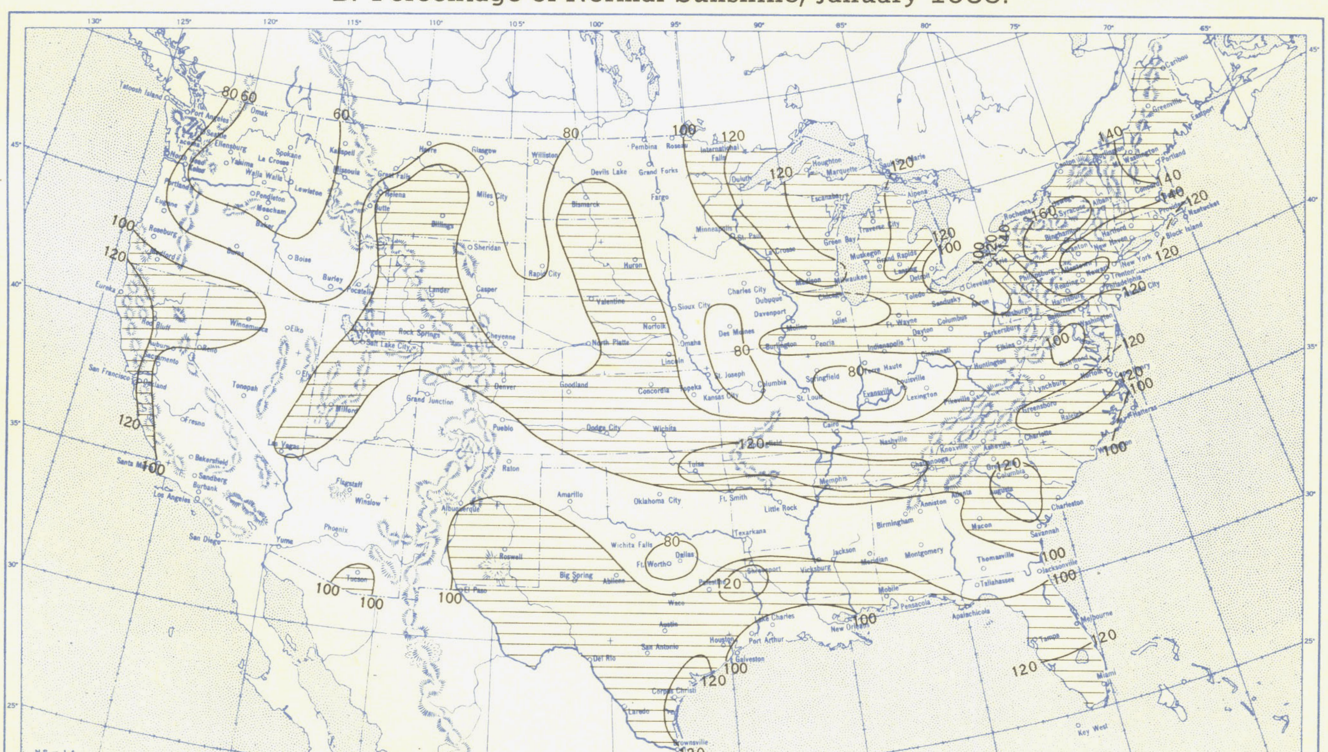
B. Percentage of Normal Sky Cover Between Sunrise and Sunset, January 1955.

A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, January 1955



B. Percentage of Normal Sunshine, January 1955.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, January 1955. Inset: Percentage of Normal Average Daily Solar Radiation, January 1955.

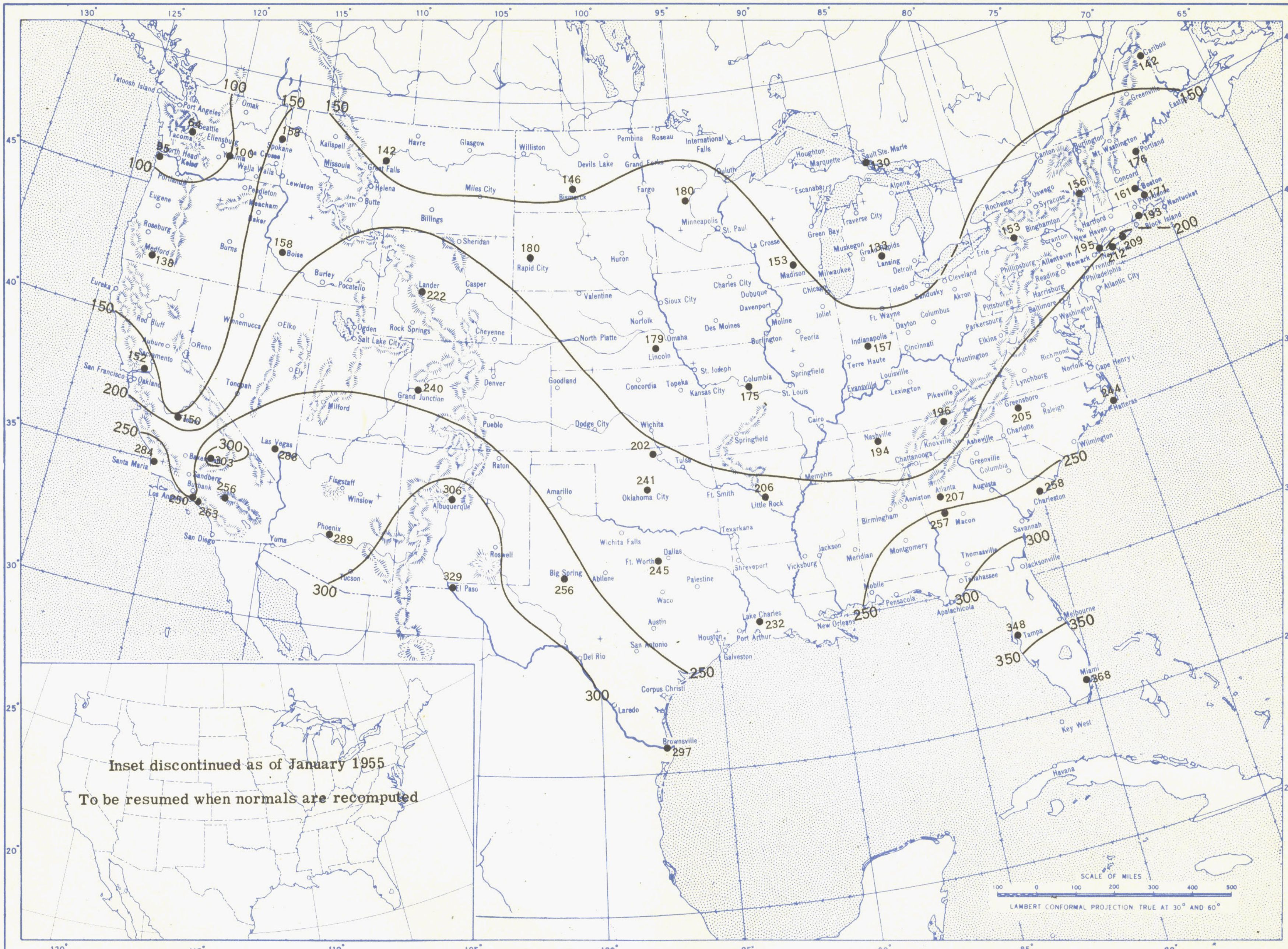
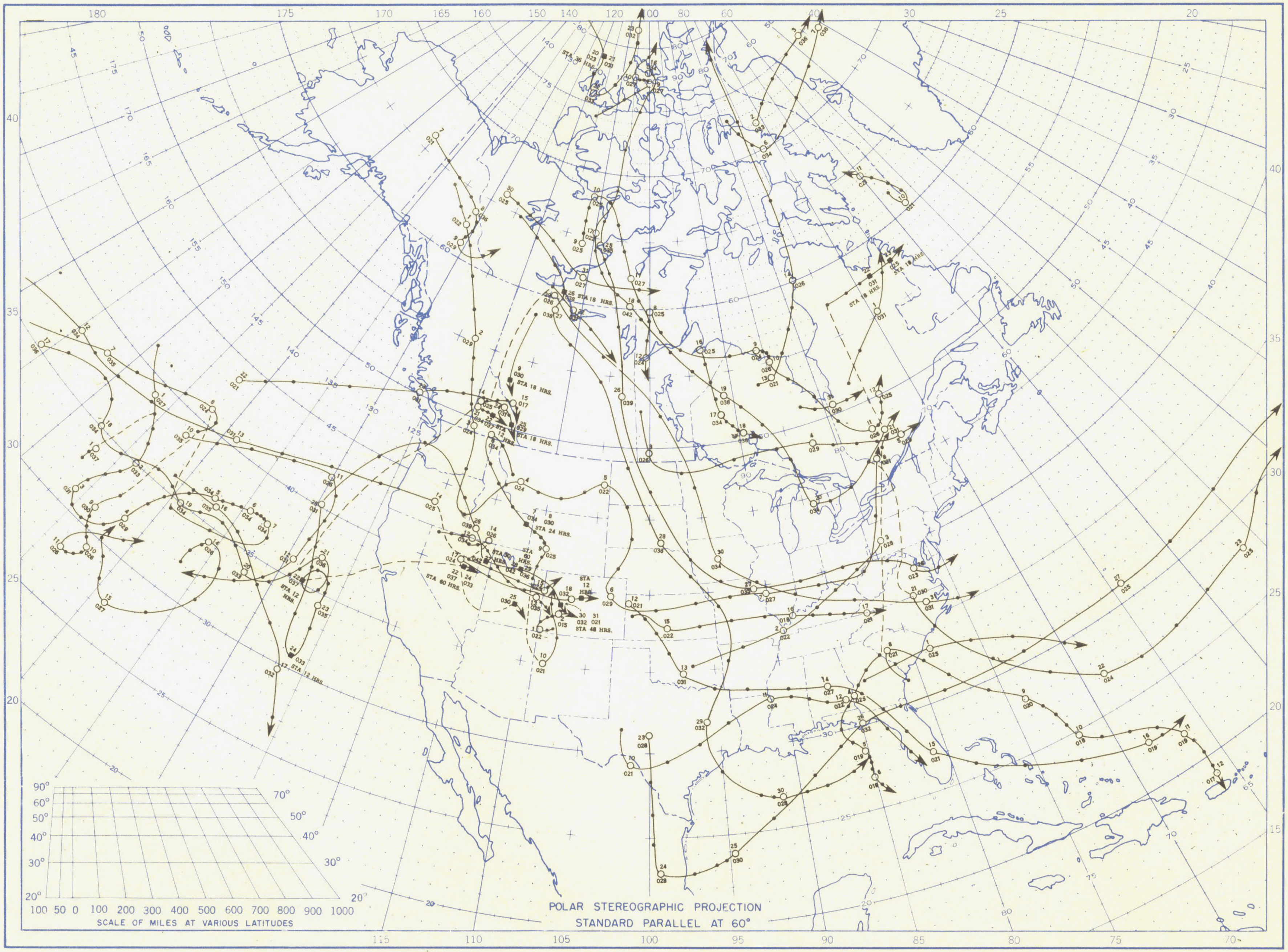


Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm.$^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown. Normals are computed for stations having at least 9 years of record.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, January 1955.



Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

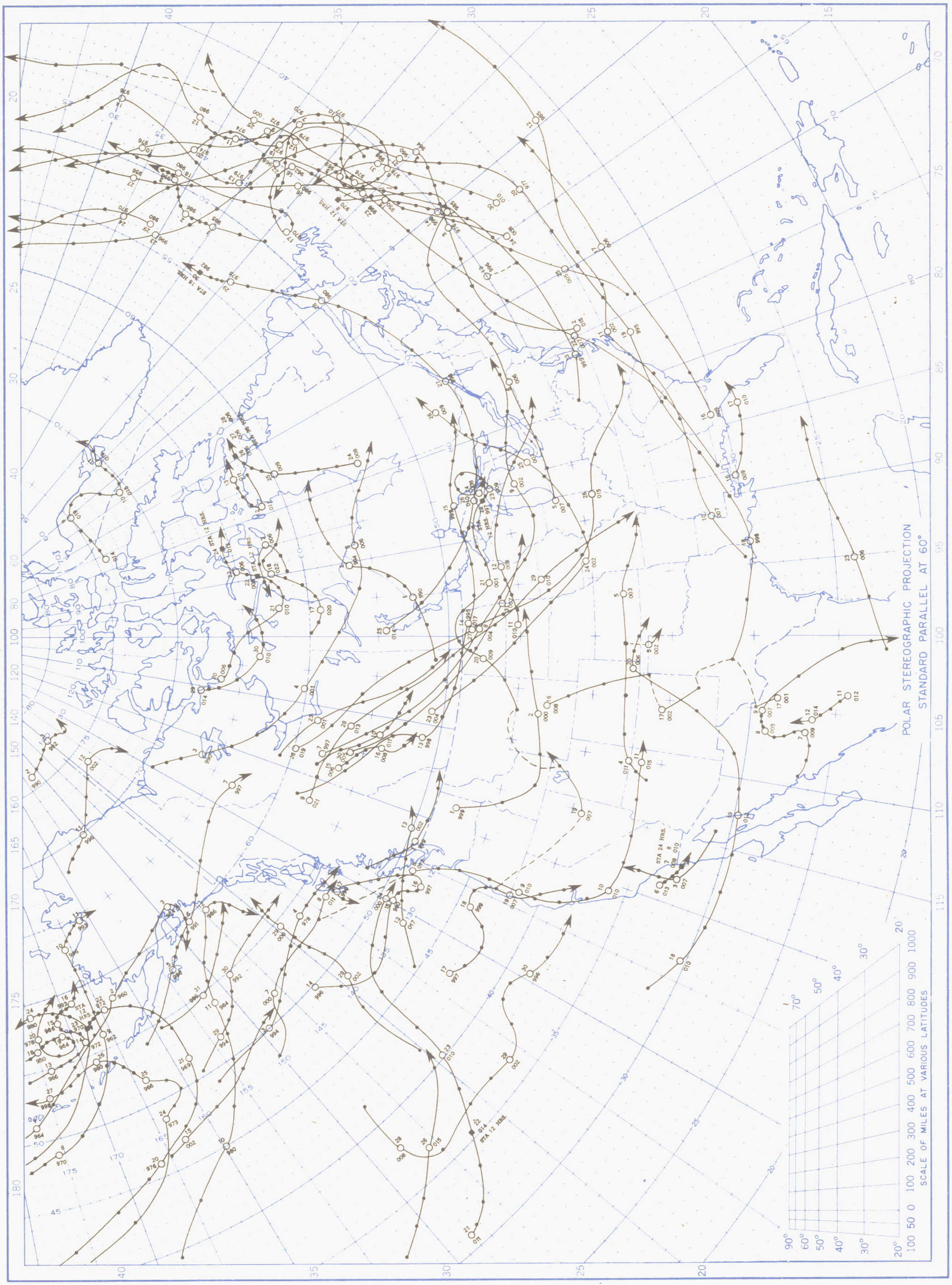
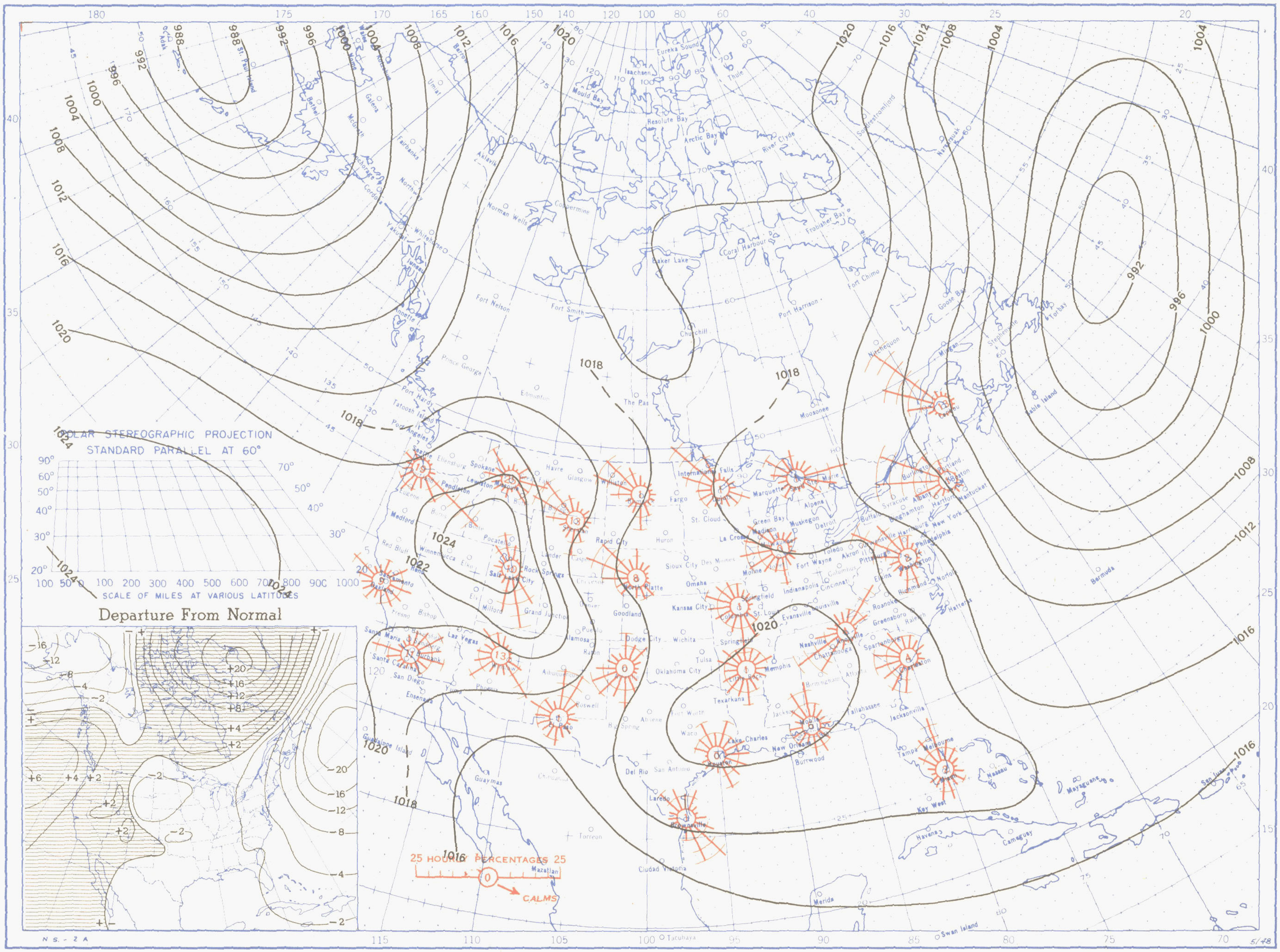


Chart X. Tracks of Centers of Cyclones at Sea Level, January 1955.

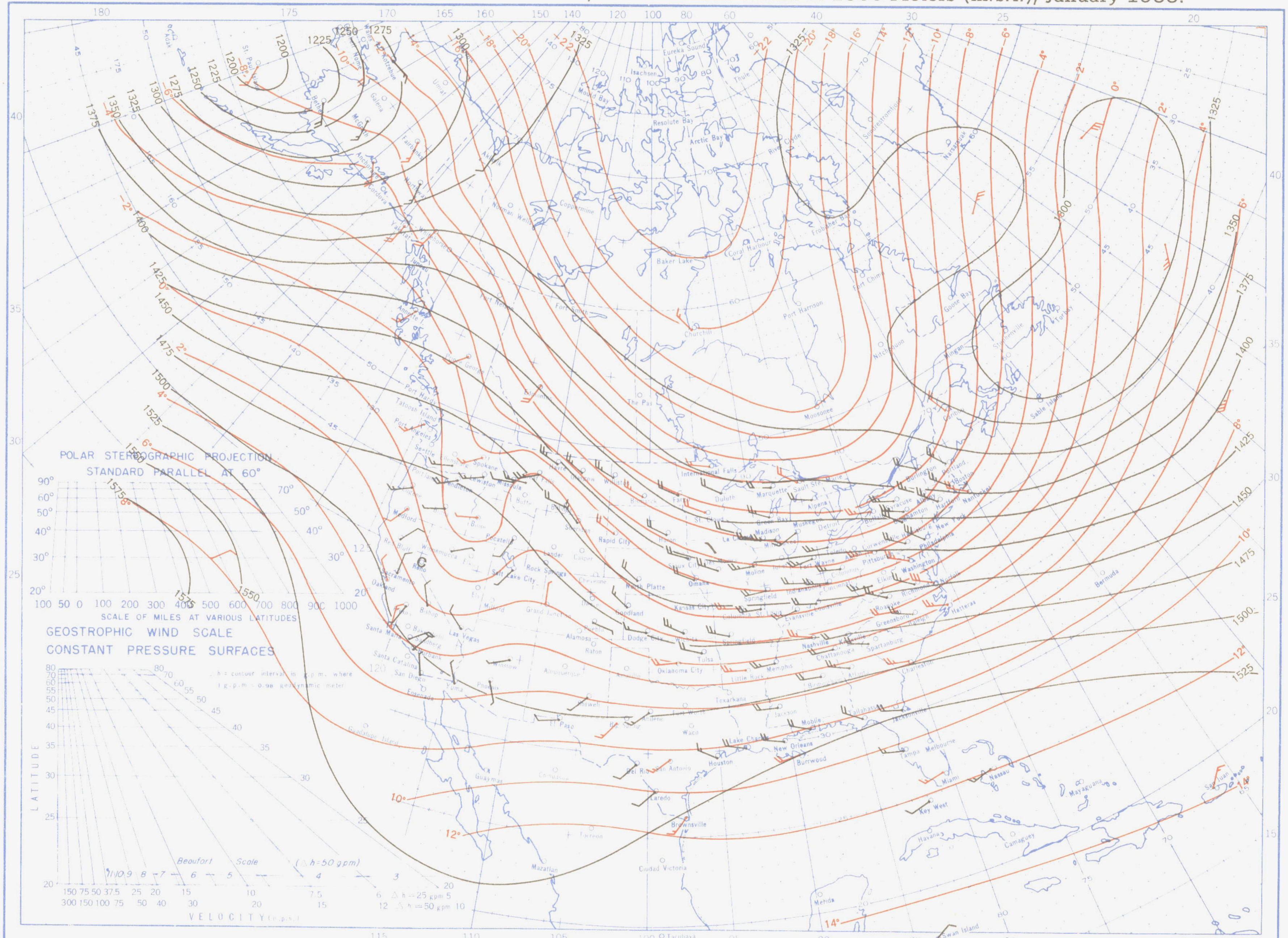
Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, January 1955. Inset: Departure of Average Pressure (mb.) from Normal, January 1955.



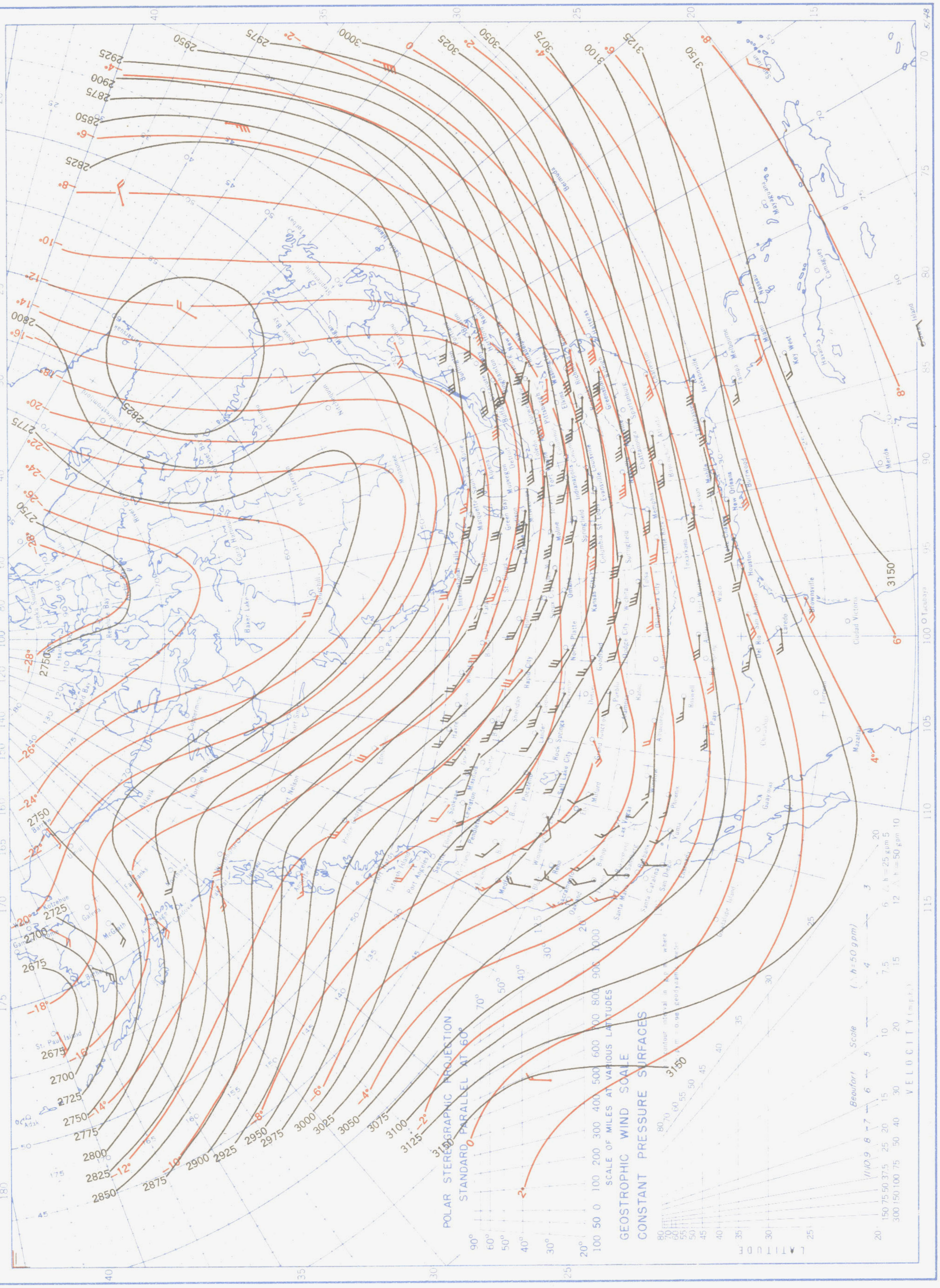
Average sea level pressures are obtained from the averages of the 7:30 a. m. and 7:30 p. m. E. S. T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 850-mb. Pressure Surface, Average Temperature in °C. at 850 mb., and Resultant Winds at 1500 Meters (m.s.l.), January 1955.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XIII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 700-mb. Pressure Surface, Average Temperature in °C. at 700 mb., and Resultant Winds at 3000 Meters (m.s.l.), January 1955.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

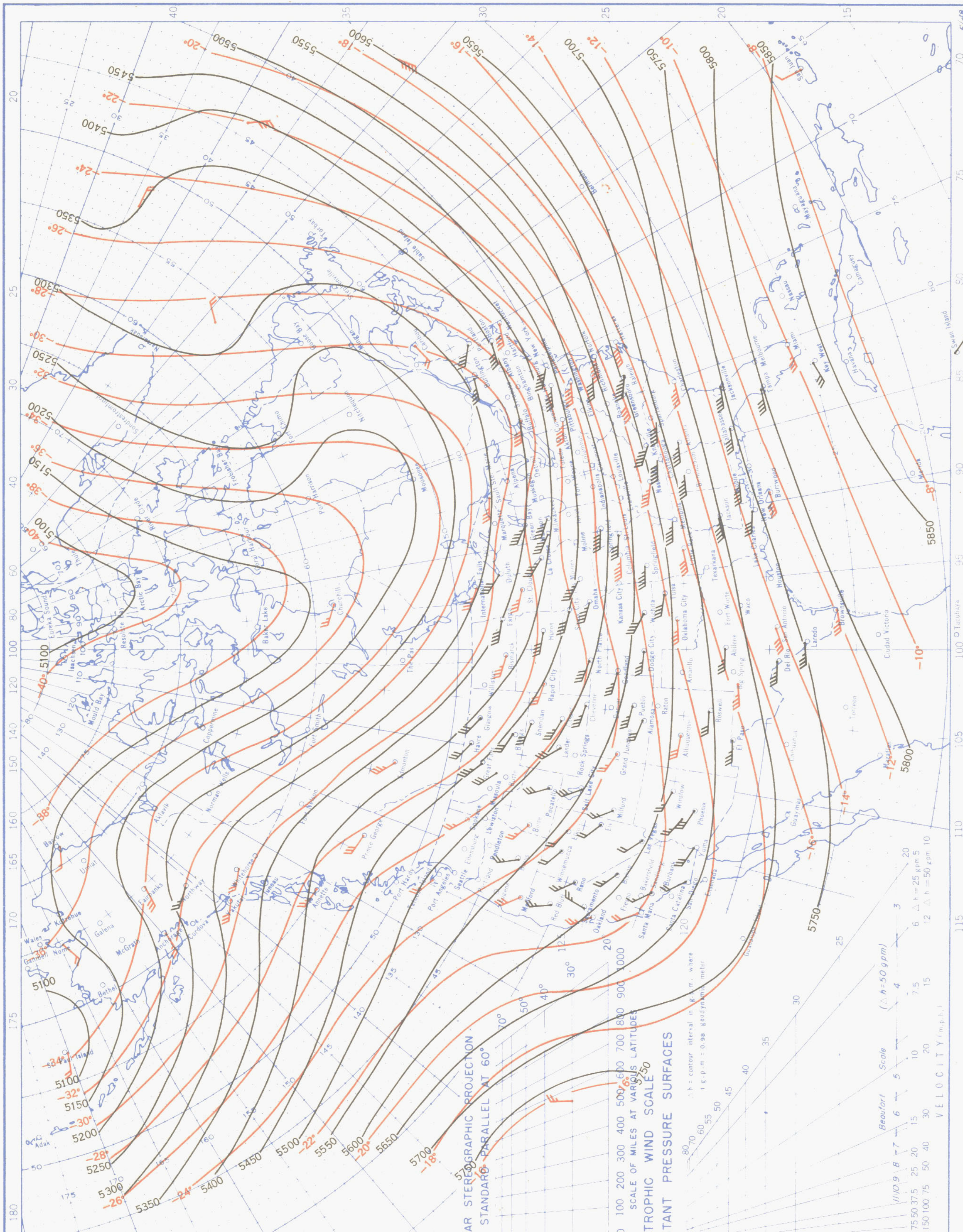
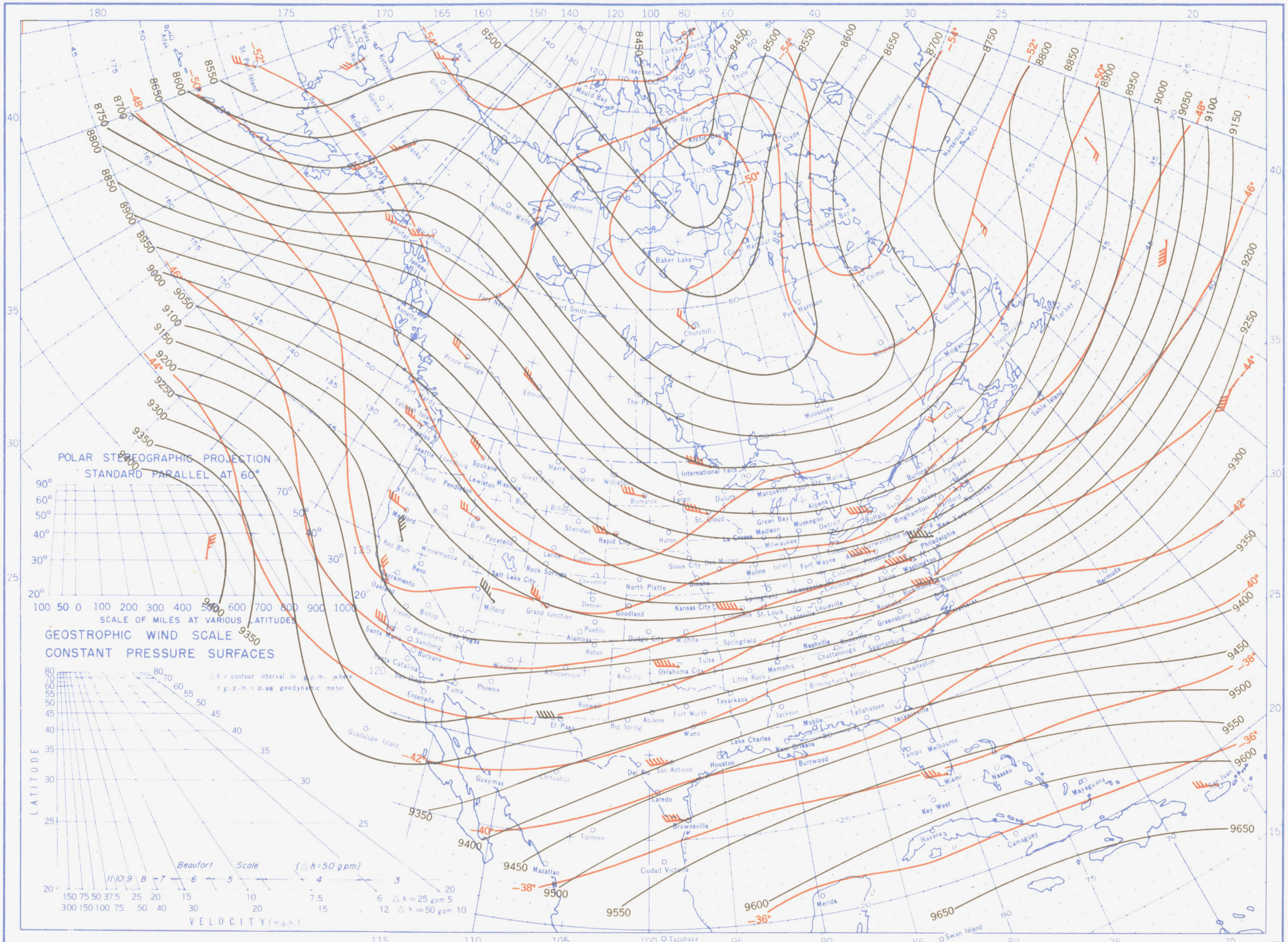


Chart XIV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 500-mb. Pressure Surface, Average Temperature in °C. at 500 mb., and Resultant Winds at 5000 Meters (m.s.l.), January 1955.

Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 300-mb. Pressure Surface, Average Temperature in °C. at 300 mb., and Resultant Winds at 10,000 Meters (m.s.l.), January 1955.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.